SGT University, Chandu-Budhera, Gurugram Faculty of Engineering & Technology Department of Mechanical Engineering





• B. Tech. Mechanical Engineering with specialization in (Robotics, Machine Design, Thermal Engineering, Computer Enable Manufacturing, Automotive Design and Development, Mechatronics, and Electric Vehicles) (Honours)

- B. Tech. Mechanical Engineering with Minor Degree in Computer Science Engineering
 - B. Tech. Mechanical Engineering with Minor Degree in Artificial Intelligence and Machine Learning.

Scheme & Syllabus (2021-22)

Vision of SGT University "Driven by Research & Innovation, we aspire to be amongst the top ten Universities in the Country by 2022"

Vision of the Department

Department endeavors to be recognized globally through outstanding education & research that produces qualified engineers who are ready to cater the everchanging industrial and social demands.

Mission of the department

To create environment conducive for the quality teaching-learning interdisciplinary research and innovation.

- \geq To establish academic system facilitating real learning in Mechanical Engineering.
- \succ To prepare the graduates be leader in the profession.
- \succ To inculcate universal human values, professional ethics and life-long learning attitude.

 \geq To empower the learners to device their own unique path of education for acquiring multi specializations and skills.

Program Specific Outcomes (PSOs)

Mechanical Engineering Graduates will be able to:

PSO1 Apply viable aptitudes, learning in significant streams, for example, Thermal, Design, Mechatronics, Manufacturing, Production and Industrial Engineering.

PSO2 Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

PSO3 Improve team building, team working and leadership skills of the students with high regard for ethical values and social responsibilities. Communicate effectively and demonstrate the knowledge of project management and independent research.

Program Educational Objectives (PEOs)

PEO1 To impart to the students' knowledge of contemporary science and mechanical engineering related subjects.

PEO2 To enhance analytical skills of the students for decision making.

PEO3 To provide opportunity to the students to expand their horizon beyond mechanical engineering.

PEO 4 To prepare the students to take-up career in different industries or to pursue higher studies in mechanical and interdisciplinary programs

PEO 5 To create awareness amongst the students towards social, environmental and energy related issues.

Program Outcomes (POs)

At the end of the Bachelor of Technology in Mechanical Engineering program graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization in mechanical engineering for the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tools Usage: Create, select, and apply proper procedure, resources, and current engineering and mechanical tools including prediction and modelling to complex engineering activities in mechanical engineering with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning inferred by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Lifelong Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Curriculum Design & Development Process

Engineering Science is a new concept of multidisciplinary program that emphasizes enhanced understanding and integrated application of engineering, science and mathematics. B. Tech. in Mechanical Engineering gaining greater acceptance from the employers, as student are industry ready possessing greater skills. The B.Tech. courses are being carefully crafted after integrating inputs from leading national and international experts both from industries as well as academia. Here are some of the highlights of the program.

• Departmental subjects are introduced from 3rd semester onwards. The curriculum is based on a unique mix of basic sciences, humanities, core engineering, and discipline-specific subjects.

• There are many choices of elective subjects, which may or may not be related to the parent discipline comes under open elective.

• The Choice based credit system is introduced. CBCS provides a "cafeteria" type approach in which the students can take courses of their choice, learn as per interest, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

• Huge emphasis is given on the industrial projects to address real-life issues and problems faced by the industries. Students are encouraged and facilitated to undergo training and internship during summer vacation to industries and/or national and international universities/research laboratories



List of programs being offered by the Department (with broad credit distribution)

A. B. Tech. Program

1. B. Tech. Mechanical Engineering with specialization in (Robotics, Machine Design, Thermal Engineering, Computer Enable Manufacturing, Automotive Design and Development, Mechatronics, and Electric Vehicles)

2. B. Tech. Mechanical Engineering with Minor Degree in Computer Science Engineering

3. B. Tech. Mechanical Engineering with Minor Degree in Artificial Intelligence and Machine Learning.

Note:

- 1. A student will be eligible to get Under Graduate degree with **Honours**, if he/she completes an additional 18-20 credits. These can be acquired through SWAYAM MOOCs. The list of MOOC courses will be provided by the Departement to the students before commencement of the semester.
- 2. Student can opt for any of the Open Elective, Value Added Course and Ability Enhancement Courses subject outside from the Parent Institute leading to Holistic Development of student. It may include Yoga, Dance, Fashion, Agriculture, Medicine, etc. These courses as mentioned in the curriculum can be opted from the University Pool which is circulated before the commencement of semester classes.
- **3.** Students entring directly in 2nd and 3rd year with Certifciate Course and Dipoma will be given Undergradute Diploma considering their credits of previous courses after successfully completion of 3rd year but the student need to submit his original previous certificate.
- 4. Students can opt for B.Tech. Mechanical Engineering with Specialization (As stated above) before commencement of the Course with prior information the Department in accordance with the eligibility criteria defined by the Academic council from time to time. As per the current criteria, a student can get B. Tech. Mechanical Engineering with Specialization Degree if she/he has 18-20 more credits of a same specialization throughout his/her program.
- 5. Students can opt for B.Tech. Mechanical Engineering with Minor Degree in Computer Science Engineering/ Artificial Intelligence and Machine Learning before commencement of the Course with prior information the Department in accordance with the eligibility criteria defined by the Academic council from time to time. As per the current criteria, a student can get B. Tech. Mechanical Engineering with Minor Degree in Computer Science Engineering/ Artificial Intelligence and Machine Learning if she/he has 18-20 more credits of a same specialization throughout his/her program.

DETAILED COURSE CONTENT & SYLLABUS B.Tech. Mechanical Engineering 2021-22



Scheme of Examination for B.Tech. (Mechanical Engineering) Program, 1st

year

SEMESTER WISE COURSE STRUCTURE 2021-2022

S.	Subject			Т	Р	С	Examin	ation	Subject
S. No.	Subject Code	Course Title					mar	Total	
110.	Coue						Int.	Ext.	
1		Applied Mathematics	3	0	0	3	40	60	100
2		Design Thinking	3	0	0	3	40	60	100
3		Basics of Mechanical Engineering	3	0	0	3	40	60	100
4		Biology for Engineers	3	0	0	3	40	60	100
5		Material Engineering and Technology	3	0	0	3	40	60	100
6		Value Addition Course-I	2	0	0	2	40	60	100
7		Ability Enhancement Course-I	2	0	0	2	40	60	100
8		Metrology and Material Engineering Lab	0	0	2	1	60	40	100
9		Workshop Technology Lab	0	0	2	1	60	40	100
10		Engineering Graphics and Design Lab	0	0	2	1	60	40	100
		Total	19	0	06	22	460	540	1000

First Semester

Second Semester

S.	Subject		L	Т	Р	С	C Examination marks		Subject
No.	<u> </u>	Course Title					ma	rks	Total
190.	Code						Int.	Ext.	
1		Applied Physics	3	0	0	3	40	60	100
2		Engineering Thermodynamics	3	0	0	3	40	60	100
3		Advance Graphics and Design	2	0	0	2	40	60	100
4		Basics of Automobile Engineering	3	0	0	3	40	60	100
5		Probability and Statistics	3	0	0	3	40	60	100
6		Ability Enhancement Course-II	2	0	0	2	40	60	100
7		Engineering Thermodynamics Lab	0	0	2	1	60	40	100
8		Advance Graphics and Design Lab	0	0	2	1	60	40	100
9		Basics of Automobile Engineering Lab	0	0	2	1	60	40	100
10		Object Oriented Programming Lab	0	0	2	1	60	40	100
		Total	16	0	08	20	500	500	1000

Note:-

1. 4 weeks mandatory Industrial Internship of 2 credits after completetion of 1^{st} year.

Exit Point

Certification Course in Mechanical Engineering.

Entry Point

Three years Diploma or One year Certification Course in Mechanical Engineering and in lieu of Industrial Internship of 4 weeks student has to complete MOOC Course of 4 weeks (2 Credits) in 3rd semester.



Scheme of Examination for B.Tech. (Mechanical Engineering) Program 2nd year

SEMESTER WISE COURSE STRUCTURE 2021-2021	22
SEMESTER WISE COURSE STREET ONE 2021 20	

S.NO.	Subject	Course Title	L	Т	Р	С	Examination		Subject
	Code						marks		Total
							Int.	Ext.	
1.		Strength of Materials	3	0	0	3	40	60	100
2.		Engineering Mechanics	3	0	0	3	40	60	100
3.		Department Electives-I	3	0	0	3	40	60	100
4.		Department Electives-II	3	0	0	3	40	60	100
5.		Open Elective-I	4	0	0	4	40	60	100
6.		Value Addition Course-II	2	0	0	2	40	60	100
7.		Strength of Materials Lab	0	0	2	1	60	40	100
8.		Engineering Mechanics Lab	0	0	2	1	60	40	100
9.		Department Electives-I Lab	0	0	2	1	60	40	100
10.		Department Electives-II Lab	0	0	2	1	60	40	100
11.		Industrial Internship	0	0	4w	2	60	40	100
		Total	18	0	08	24	540	560	1100

Third Semester

Fourth Semester

S.NO.	Subject	Course Title	L	Т	Р	С	Exan	ninatio	Subject
	Code						n m	arks	Total
							Int.	Ext.	
1.		Mechanical Machine Design	3	0	0	3	40	60	100
2.		Manufacturing Processes and Technology	3	0	0	3	40	60	100
3.		Research Methodology	3	0	0	3	40	60	100
4.		Department Electives-III	3	0	0	3	40	60	100
5.		Department Electives-IV	3	0	0	3	40	60	100
6.		Open Elective-II	4	0	0	4	40	60	100
7.		Mechanical Machine Design Lab	0	0	2	1	60	40	100
8.		Manufacturing Processes Lab	0	0	2	1	60	40	100
9.		Department Electives-III Lab	0	0	2	1	60	40	100
10.		Department Electives-IV Lab	0	0	2	1	60	40	100
		Total	19	0	08	23	480	520	1000

Note: -

1. 4 weeks mandatory Industrial Training-I of 2 credits after completetion of 2nd year.

Specialization Stream for Department Electives	Department Electives-I	Department Electives-II	Department Electives-III	Department Electives-IV		
Thermal	Refrigeration & Air Conditioning 3-0-2 (4)	Steam Power Generation 3-0-2 (4)	Cryogenic Engineering 3-0-2 (4)	Fluid Power System 3-0-2 (4)		
Manufacturing	Advanced Machining Processes 3-0-2 (4)	Production Planning & Control 3-0-2 (4)	Computer Aided Manufacturing 3-0-2 (4)	CNC Programming 3-0-2 (4)		
Automotive Technology	Advance Automobile Engineering 3-0-2 (4)	Fuel & Combustion 3-0-2 (4)	Hydrogen and Fuel Cells 3-0-2 (4)	Chassis Design 3-0-2 (4)		
Industrial Engineering & Management	Industrial Engineering 3-0-2 (4)	Estimation & Costing / Total Quality Management 3-0-2 (4)	Plant Layout and Material Handling / Lean enterprise & Advanced Manufacturing Technologies 3-0-2 (4)	Work Study/Supply Chain and Logistic Managements 3-0-2 (4)		
Machine Design	Product Design for Manufacturing 3-0-2 (4)	Tool Design 3-0-2 (4)	Mechanical Vibration 3-0-2 (4)	Finite Element Methods 3-0-2 (4)		
Material & Metallurgy	Advance Materials 3-0-2 (4)	Composite Materials 3-0-2 (4)	Nanomaterials 3-0-2 (4)	Biomaterials 3-0-2 (4)		

Exit Point

Diploma in Mechanical Engineering with specialization in_____.

Entry Point

Certification Course in Mechanical Engineering and in lieu of Industrial Training-I of 6 weeks student has to complete MOOC Course of atleast 6 weeks (3 Credits) in 5th semester.



Scheme of Examination for B.Tech. (Mechanical Engineering) Program

S.NO.	Subject	Course Title	L	Т	Р	С	Examination		Subject
	Code						marks		Total
							Int.	Ext.	
1.		Fluid Mechanics and Machines	3	0	0	3	40	60	100
2.		Kinematics of Machines	3	0	0	3	40	60	100
3.		Department Electives-V	3	0	0	3	40	60	100
4.		Department Electives-VI	3	0	0	3	40	60	100
5.		Open Elective-III	4	0	0	4	40	60	100
6.		Ability Enhancement Course-III	2	0	0	2	40	60	100
7.		Fluid Mechanics and Machines Lab	0	0	4	2	60	40	100
8.		Kinematics of Machines Lab	0	0	2	1	60	40	100
9.		Department Electives-V Lab	0	0	2	1	60	40	100
10.		Department Electives-VI Lab	0	0	2	1	60	40	100
11.		Industrial Training-I	0	0	4w	2	60	40	100
		Total	18	0	10	25	500	500	1000

Fifth Semester

Sixth Semester

S.NO.	Subject	Course Title	L	Т	Р	С	Examinatio		Subject
	Code						n m	arks	Total
							Int.	Ext.	
1.		Heat and Mass Transfer	3	0	0	3	40	60	100
2.		Dynamics of Machines	3	0	0	3	40	60	100
3.		Department Electives-VII	3	0	0	3	40	60	100
4.		Department Electives-VIII	3	0	0	3	40	60	100
5.		Open Elective-IV	4	0	0	4	40	60	100
6.		Value Addition Course-III	2	0	0	2	40	60	100
7.		Heat and Mass Transfer Lab	0	0	2	1	60	40	100
8.		Dynamics of Machines Lab	0	0	2	1	60	40	100
9.		Department Electives-VII Lab	0	0	2	1	60	40	100
10.		Department Electives-VIII Lab	0	0	2	1	60	40	100
		Total	18	0	08	22	480	520	1000

Note:-

1. 4 weeks mandatory Industrial Training-II of 2 credits after completetion of 3rd year.

Department Electives Specialization Streams	Department Electives-V	Department Electives -VI	Department Electives- VII	Department Electives-VIII		
Robotics	Robotics Engineering & Applications 3-0-2 (4)	Sensors & Actuators 3-0-2 (4)	Pneumatics & Control 3-0-2 (4)	Mobile Robots 3-0-2 (4)		
Thermal Engineering	Solar & Nuclear Power Engineering 3-0-2 (4)	Design of Thermal Systems 3-0-2 (4)	Power Plant Engineering 3-0-2 (4)	Computational Fluid Dynamics 3-0-2 (4)		
Computer Enable Manufacturing	Rapid Manufacturing Technologies 3-0-2 (4)	Non-Conventional Machining 3-0-2 (4)	Non-Destructive Evaluation & Testing 3-0-2 (4)	Press Tools & Dies 3-0-2 (4)		
Machine Design	Design for Manufacturing & Assembly 3-0-2 (4)	Mechanism & Manipulator Design 3-0-2 (4)	Advance Tribology 3-0-2 (4)	Finite Element Analysis 3-0-2 (4)		
Automotive Design & Development	Advance Automotive Electronics 3-0-2 (4)	Engine Design 3-0-2 (4)	Design of Transmission System 3-0-2 (4)	Vehicle Body Dynamics 3-0-2 (4)		
Mechatronics	Mechatronics Systems and its Applications 3-0-2 (4)	Sensors & Actuators 3-0-2 (4)	Pneumatics & Control 3-0-2 (4)	MEMS & Micro-Systems 3-0-2 (4)		
Electric Vehicles	Introduction to Hybrid and Electric Vehicles 3-0-2 (4)	Battery Management System 3-0-2 (4)	Plug-in Electric Vehicles in Smart Grid 3-0-2 (4)	EV Charging Infrastructure Technology 3-0-2 (4)		

Exit Point

Undergraduate Diploma in Mechanical Engineering with specialization in_____.

Entry Point

Diploma in Mechanical Engineering and in lieu of Industrial Training of 6 weeks student has to complete MOOC Course of atleast 6 weeks (3 Credits) in 7th semester.



Scheme of Examination for B.Tech. (Mechanical Engineering) Program 4th year

SEMESTER WISE COURSE STRUCTURE 2021-2022

Seventh	Semester
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S.	Subject	Course Title	L	Т	Р	С	Examination		Subject
NO.	Code						ma	rks	Total
							Int.	Ext.	
1.		Automation in Manufacturing	3	0	0	3	40	60	100
2.		Department Electives-IX	3	0	0	3	40	60	100
3.		Department Electives-X	3	0	0	3	40	60	100
4.		Value Addition Course-IV	2	0	0	2	40	60	100
5.		Ability Enhancement Course-IV	2	0	0	2	40	60	100
6.		Automation in Manufacturing Lab	0	0	2	1	60	40	100
7.		Department Electives Lab-IX	0	0	2	1	60	40	100
8.		Department Electives Lab-X	0	0	2	1	60	40	100
9.		Capstone Project	0	0	4	2	60	40	100
10.		Industrial Training-II	0	0	4w	2	60	40	100
		Total	13	0	10	20	500	500	1000

Eighth Semester

S.NO.	Subject Code	Course Title	L	Т	Р	С		nation rks	Subject Total
							Int.	Ext.	
1.		Industrial Internship with Project (Industrial oriented/Research oriented)	-	-	20 W	10	100	100	200
		Total Credits = 10							
	Overall To	tal Credits = I to VIII= 166							

Department Electives	Department Electives-IX	Department Electives-X
Thermal	Nuclear Power Engineering 3-0-2 (4)	Advance Heat Transfer 3-0-2 (4)
Computer Enable Manufacturing	Machine Tool Technology 3-0-2 (4)	Modelling and Simulation of Manufacturing System 3-0-2 (4)
Automotive Technology	Recent Trends in Automotive Technology 3-0-2 (4)	Gas Dynamics & Jet Propulsion 3-0-2 (4)
Industrial Engineering & Management	Maintenance Engineering / Operation Research 3-0-2 (4)	Industrial Safety Engineering / Sales & Marketing 3-0-2 (4)
Mechatronics	Instrumentation & Control Engineering 3-0-2 (4)	Neural Networks and Fuzzy Systems 3-0-2 (4)
Material & Metallurgy	Nano-Technology and Surface Engineering 3-0-2 (4)	Aerospace Materials 3-0-2 (4)
Robotics	Robot Operating Systems 3-0-2 (4)	Cognitive Robotics 3-0-2 (4)
Electric Vehicles	Modelling and Simulation of EHV 3-0-2 (4)	Autonomous Vehicles 3-0-2 (4)

Exit Point

Degree in Mechanical Engineering with specialization in_____.

1st Semester

1. Name of the Departn	nent- Mechanical En	gineering				
2. Course Name	Applied	L	Т		Р	
	Mathematics					
3. Course Code		3	0		0	
4. Type of Course (use	tick mark)	Core ()	• PE ()	BSC	OE ()	EAS ()
, , , , , , , , , , , , , , , , , , ,	<i>,</i>	·	~	(🗸)	, v	-
5. Pre-requisite (if	+2 Math	6. Frequency (use	Even	Odd	Either	Every
any)		tick marks)	0	(✓)	Sem ()	Sem ()
	tures, Tutorials, Pra	ctical (assuming 14 week	1			
Lectures = 42		Tutorials = 0	Practica	al = 0		
8. Course Description						
recursive programming, problems in engineering analyzing the real-world	multiple integrations & sciences. Enhance problems of sciences	applications like differenti and Laplace transform be t and develop the ability of and engineering.	the tool fo	r solving	the real-lif	e
9. Learning Objective	s:					
students understaComputer Scienceii) To aware studeniii) To promote the or	and and appreciate the ce. ts about computer, its	betencies that is majorly us basic mathematical know functions and utilities. uter-related skills for immo	ledge whi	ch is func	lamental to	-
curricular areas.iv) To provide a fou	ndation for post-seco	ndary education.				
10. Course Outcomes (<u> </u>	induly education.				
ii) Solve differentiaiii) Present mathemaiv) Solve linear syst	tical models of physic l equations using app atical solutions in a co em of equations by di	-	determin			igen
11. Unit wise detailed c	ontent					
Unit-1	Number of lectures = 10	Title of the unit: Matric	ces			
	scalar multiplication verse of matrix, Gaus	n, matrix multiplication; I s elimination and Gauss Jo pr.			-	
Unit – 2	Number of lectures = 10	Title of the unit: Laplac	ce Transf	orms & a	pplication	l
	division by t, LT of th	rm: Solution based on Def ne derivative, LT by multip		•	· ·	•
Unit – 3	Number of lectures = 11	Title of the unit: Calcul	us			
•		ables (without proof), Parti Cartesian & polar form.				÷
Unit – 4	Number of lectures = 11	Title of the unit: Differe	ential equ	ation & i	ts applica	tion

Exact differentia equation, Application of DE of first order and first degree to simple electric circuits, Linear differential equation of 2nd and higher order., Method of variation, Cauchy's and Lagrendre's linear equations, Application of linear differential equations to electric circuits.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Be	ooks Recommended
Text l	Books
i)	N. P. Bali and Manish Goyal, A text book of engineering mathematics, Laxmi publication, 2010
Refer	rence Books
i)	H.K.Dass, A text book of engineering mathematics, S.Chand & Company LTD
ii)	B.S.Grewal, A text book of engineering mathematics, Khanna publication.
iii)	Elements of Engineering Mathematics, Liu, Tata Mac Graw Hills.
iv)	Kolman B, Busby R.C. and Ross S., Engineering Mathematical Structures for Computer Science, Fifth Edition, Prentice Hall of India, New Delhi, 2006.

1. Name of the Depart	nent- Mechanical Er	ngineering				
2. Course Name	Design	L	Т		Р	
	Thinking					
3. Course Code		3	0		0	
4. Type of Course (use	tick mark)	Core ()	PE ()	BSC ()	OE ()	EAS (✓)
5. Pre-requisite (if		6. Frequency (use	Even	Odd	Either	Every
any)		tick marks)	0	(🗸)	Sem ()	Sem ()
7. Total Number of Le	ctures, Tutorials, Pra	actical (assuming 14 week	s of one s	emester)		
Lectures = 42		Tutorials = 0	Practica	al = 0		
8. Course Description						
Design thinking is a syst	tematic method of sol	ving problems. This metho	d is uniqu	e that it sta	arts and er	nds with
humans. The design thin	kers start by observin	g, interviewing or just plai	n experier	ncing a situ	ation. Th	en, they
proceed to improve the s	situation of the human	s by solving problems for t	them. This	s course fa	miliarizes	you with
the concept of "innovation	on" and the journey of	f a design idea from the ide	ntification	n of a prob	elem to a f	inal
solution that has a positi	· •	community of users.				
9. Learning Objective						
		f-the-art perspectives, idea				ated to the
		driven projects using desig				a .
		and growth mindset form of	of problen	n identifica	ation and	reframing,
0	dsight and insight ger		duine la			
		line of systemic inspiration				
atmosphere.	rees of ideas, new con	nnections and new models	specially	outside the	eir regulai	operating
-	concrete feasible vi	able and relevant innovatio	n nroiect	/challenge	د د	
10. Course Outcomes (/ chancing c		
	he concepts of design					
		conduct design thinking ses	sions.			
		sign thinking in parallel to		blems.		
	-	pts to their daily work.				
11. Unit wise detailed of		• •				
Unit-1	Number of	Title of the unit: Introdu	ction to E	Design Th	inking	
	lectures = 10			U	U	
What Is Design Thinking	1	nd for Innovation, Empathi	ze Phase	Customer	Lourney N	Janning
0					•	
Analyze Phase: 5-Whys a	and How might we,	Idea Generation, Free Brain	nstorming	& Make/	l'est Phase	:
Prototype, Experimentation	on.					
Unit – 2	Number of	Title of the unit: Innovat	ion by De	esign		
	lectures $= 10$			~-8		
The Seven Concerns, I		Collaboration, Challenges	to Innov	ation. Un	derstandir	g Users.
	0	Jser Feedback, The First C				•
<u> </u>		ent, New users, New needs			•	
TT 1/ 0	- -		C	<u> </u>		10
Unit – 3	Number of	Title of the unit: Context	, Compre	enension,	Check an	d Cause
	lectures = 11	The section of the se		TTI. 117 1		<u>Carran</u> i
		Ingenious Attempt, Furthe	r Insights,	The Wor	king Rig,	Concepts
Generation, Experiencin	+		a the Dra	duct Errel	oring Des	aibilition
		ding Constraints, Positionin logy, At the 2 nd Valley of D				sionnes,
-	-	luct, the Users and the Cont		-		eds The
Crucial Step Missed.	k and Cause, the pilot	uce, the Osers and the COIN	, 1 пе г	rototypin	\mathbf{s}, \mathbf{o}	
Cracial Step Missea.						

~	- 4	Number of	Title of the unit: Conception, Crafting and Connection
		lectures = 11	
The 1	Fifth C: The Conce	ption, Synchronic S	Studies, One Product, many problems, Concept Clusters, From
Idea	to Product, Prototyp	ing, Material and T	Cechnologies, Collaborative Efforts.
The S	Sixth C: The Crafting	g, Recap, The Manu	ufacturing Challenge, The User Feedback, The Iterative Process.
The S	Seventh C: The Con	nection, The Seed for	or Innovation, Pinnacle for Innovation, The Innovation Timeline,
The I	Innovation Champio	ns, The Innovation	Domain, The Innovation Template, The Serial Innovation.
12. B	Brief Description of	self-learning / E-le	earning component
The	students will be enc	ouraged to learn usi	ing the SGT E- Learning portal and choose the relevant lectures
deliv	vered by subject exp	erts of SGT Univers	sity.
The	link to the E-Learnin	ng nortal	
The l	link to the L-Leanin	ig portai.	
http:/	//sgtlms.org		
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	<u> </u>	n the respective fiel	ld.
	nal papers; Patents i Books Recommende	-	ld.
13. B	<u> </u>	-	ld.
13. B Text	Books Recommende Book	d	ld. rthy, Battula Kalyana, and Janaki Krishnamoorthy, Springer India,
13. B Text	Books Recommende Book	d Design by Chakrava	
13. B Text i)	Books Recommende Book Innovation By D	d Design by Chakrava	
13. B Text i) Refe	Books Recommende Book Innovation By D 2013, ISBN 978 rence Books	d Design by Chakrava -81-322-0901-0	
13. B Text i)	Books Recommende Book Innovation By D 2013, ISBN 978 rence Books Innovation by D	d Design by Chakrava -81-322-0901-0 esign: How Any Or	rthy, Battula Kalyana, and Janaki Krishnamoorthy, Springer India,
13. B Text i) Refe	Books Recommender Book Innovation By D 2013, ISBN 978 rence Books Innovation by D Drive New Ideas	d Design by Chakrava -81-322-0901-0 esign: How Any Or	rthy, Battula Kalyana, and Janaki Krishnamoorthy, Springer India, rganization Can Leverage Design Thinking to Produce Change, ningful Solutions by Thomas Lockwood, New Page Books, US; 1st
13. B Text i) Refe	Books Recommende Book Innovation By D 2013, ISBN 978 rence Books Innovation by D Drive New Ideas edition (28 Nove	d Design by Chakrava -81-322-0901-0 esign: How Any Or s, and Deliver Mear ember 2017), ISBN	rthy, Battula Kalyana, and Janaki Krishnamoorthy, Springer India, rganization Can Leverage Design Thinking to Produce Change, ningful Solutions by Thomas Lockwood, New Page Books, US; 1st

Engineering 3 3. Course Code	ore (✓)	0			
				0	
4. Type of Course (use tick mark) Co	$re(\mathbf{x})$				
	ne (*)	PE ()	OE 0	EAS ()	BSC (✓)
5. Pre-requisite (if any)Physics at +2 Level6.	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem (
7. Total Number of Lectures, Tutorials, Prac	ctical (assuming 14 we	eks of one	semeste	r)	
	itorials = 0	Practical :		/	
 9. Learning objectives: The course aims to deal with the con 10. Course Outcomes (COs): Upon successful completion of this course studer Understanding the concept of thermodia Understanding the concept of Power Understanding the concept of stress a 	ncept of RAC and hydra ncept of Power Transmin ncept of stress and strain nts can: odynamics and steam g and hydraulic pump and r Transmission and Inte	enerator.	and turbi nternal C	nes. combustion	Engine.
11. Unit wise detailed content					
Unit-1 Number of Tit	tle of the unit: Therm	odynamics	, and Ste	eam	
lectures = 12					
Basic concept of thermodynamics: Introduction law of thermodynamics, Concept of internal errest throttling processes, flow processes for an ide (Isobaric), constant temperature (Isothermal, adia Properties of Steam & Steam Generator: Form of Steam, Use of steam tables, Measurement of d Unit – 2 Number of	nergy, enthalpy and er eal gas under constant abatic and polytrophic on nation of steam at const	ntropy. Ana volume (Is conditions), ant pressure ttling calori	lysis of sochoric) Problem , Thermo meter.	free expan), constant 18 odynamic p	sion and pressure properties
	ydraulic Turbines and				
		-			
Refrigeration & Air-Conditioning: Introduction machines, Coefficient of performance, Simple re					
its use, working of a domestic refrigerator, Huma			ie, i sych		arts allu

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, characteristics curve of hydraulic turbines, draft tube, Classification of water pumps and their working.

Unit – 3	Number of	Title of the unit: Power Transmission and Internal
	lectures = 10	Combustion Engine

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, types of belt, slip of the belt, creep of the belt, tension ratios of belts, minimum and maximum tension in belt, rope drive-ratio of driving tensions, chain drive and its terminology, pulley drive, gear drive, gear train Types and functioning of clutches, single and multi-plate clutch, cone clutch, centrifugal clutch, diaphragm clutch, dog clutch.

Internal Combustion Engines: Introduction of engines & their classification, basic engine components, basic engine terminology nomenclature, four stroke and two stroke diesel and petrol cycle, comparison of S.I. and C.I. engines, lubricating system, cooling system.

Unit – 4	Number of	Title of the unit: Stresses and Strain
	lectures = 10	

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison's ratio, stresses and strains in simple and compound bars under axial, flexure & torsional loading, Stress- strain diagrams, Hooks law, Elastic constants & their relationships, factor of safety, torsional loading, torque, torsion equation, shear force and bending moment diagrams for cantilevers, simply supported.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Books

- R. K. Rajput, Elements of Mechanical Engineering Lakshmi Publication, 2019 Delhi, ISBN 9788126518784
- ii) D. S. Kumar, Elements of Mechanical Engineering, S.K. Kataria and Sons, 2021, ISBN:9350147289

Reference Books

- i) P. K. Nag Engineering Thermodynamics- TMH, New Delhi ,2017, ISBN: 9789352606429
- Arora & Domkundwar, Refrigeration & Air conditioning, Dhanpat Rai & Co. Pvt. Ltd., 2021, ISBN: 9390385849

	tment- Mechanical l	Engineering				
2. Course Name	Biology for	L	Т		Р	
	Engineers					
3. Course Code		3	0		0	
4. Type of Course (us	se tick mark)	Core ()	PE ()	BSC	OE ()	EAS ()
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			(\checkmark)	020	
5. Pre-requisite (if	NA	6. Frequency (use	Even	Odd	Either	Every
any)		tick marks)	0	(√)	Sem ()	Sem ()
-	ectures. Tutorials. P	ractical (assuming 14 wee	0		0	
Lectures = 42		Tutorials = 0	Practic		,	
8. Course Description	1					
		f biology in which signific	ant advan	ces in the	understan	ding and
	-	ed. The significant impact of				-
	-	ts and an overall better qu		-		
		biology to be able to und	•		• •	
U		respective of the parent d	-	1		U
		bability of using the discipl	-			
		e is designed to convey the				
		nderstanding, and contribut				i biology
*		nderstanding, and contribut	ion by any	mereste	u person.	
9. Learning Objecti		· · · · · · · · · · · · · · · · · · ·				
	<u> </u>	ts from an engineering pers		0.000		
		on between biology and fut		0		
		on for biological and life sc	tience chai	lenges.		
	and the Physiological					
		will be able to:				
		will be able to: -	nostivo			
i) Understand	the biological concept	ots from an engineering pers				
i) Understandii) Understand	the biological concept the concepts of biolo	ots from an engineering per- gical sensing and its challer	nges			
i) Understandii) Understandiii) Understand	the biological concept the concepts of biolo development of artifi	ots from an engineering pers gical sensing and its challer icial systems mimicking hu	nges man action			
 i) Understand ii) Understand iii) Understand iii) Integrate bi 	the biological concept the concepts of biolo development of artificity ological principles for	ots from an engineering per- gical sensing and its challer	nges man action			
 i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed 	the biological concept the concepts of biolo development of artific ological principles for content	ots from an engineering per- gical sensing and its challen icial systems mimicking hur r developing next generation	nges man action n technolo	gies		
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 i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 	the biological concept the concepts of biolo development of artific ological principles for content Number of lectures = 10 Significance, Bio Insp	ots from an engineering pers gical sensing and its challen icial systems mimicking hui r developing next generatio Title of the unit: Need t	nges man action n technolo o study Bi Biology in	gies ology Next Ger		
 i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 	the biological concept the concepts of biolo development of artific ological principles for content Number of lectures = 10 Significance, Bio Insp	ots from an engineering person gical sensing and its challen icial systems mimicking hum r developing next generation Title of the unit: Need to pired Inventions, Role of E	nges man action n technolo o study Bi Biology in	gies ology Next Ger		
 i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Studies 	the biological concept the concepts of biolo development of artific ological principles for content Number of lectures = 10 Significance, Bio Insp ructure, Cell Potential	ots from an engineering person gical sensing and its challen icial systems mimicking hum r developing next generation Title of the unit: Need to pired Inventions, Role of E , Action Potential, ECG and	nges man action <u>n technolo</u> o study Bi Giology in d other con	gies ology Next Ger nmon sigr		
 i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 	the biological concept the concepts of biolo development of artificological principles for content Number of lectures = 10 Significance, Bio Insp ructure, Cell Potential Number of	ots from an engineering person gical sensing and its challen icial systems mimicking hum r developing next generation Title of the unit: Need to pired Inventions, Role of E	nges man action <u>n technolo</u> o study Bi Giology in d other con	gies ology Next Ger nmon sigr		
 i) Understand ii) Understand iii) Understand iv) Integrate bis 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Stratege Unit – 2	the biological concept the concepts of biolo development of artificities for content Number of lectures = 10 Significance, Bio Insp ructure, Cell Potential Number of lectures = 10	ots from an engineering pers gical sensing and its challen icial systems mimicking hui r developing next generatio Title of the unit: Need t pired Inventions, Role of E , Action Potential, ECG and Title of the unit: Nervor	nges man action n technolo o study Bi Giology in d other con us System	gies ology Next Ger nmon sigr s	nals – Sodiu	ım.
 i) Understand ii) Understand iii) Understand iv) Integrate bis 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Stratege Unit – 2	the biological concept the concepts of biolo development of artificities for content Number of lectures = 10 Significance, Bio Insp ructure, Cell Potential Number of lectures = 10	ots from an engineering person gical sensing and its challen icial systems mimicking hum r developing next generation Title of the unit: Need to pired Inventions, Role of E , Action Potential, ECG and	nges man action n technolo o study Bi Giology in d other con us System	gies ology Next Ger nmon sigr s	nals – Sodiu	ım.
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i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit - 2 Potassium channels,	the biological concept the concepts of biolo development of artificities for content Number of lectures = 10 Significance, Bio Insp ructure, Cell Potential Number of lectures = 10 Number of lectures = 10 Neuron function, Cer	ots from an engineering pers gical sensing and its challen icial systems mimicking hui r developing next generatio Title of the unit: Need t pired Inventions, Role of E , Action Potential, ECG and Title of the unit: Nervor	nges man action n technolo o study Bi Giology in d other con us System	gies ology Next Ger nmon sigr s	nals – Sodiu	ım.
i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit - 2 Potassium channels,	the biological concept the concepts of biolo development of artificities for content Number of lectures = 10 Significance, Bio Insp ructure, Cell Potential Number of lectures = 10 Number of lectures = 10 Neuron function, Cer	ots from an engineering pers gical sensing and its challen icial systems mimicking hui r developing next generatio Title of the unit: Need t pired Inventions, Role of E , Action Potential, ECG and Title of the unit: Nervor	nges man action n technolo o study Bi Biology in d other con us System rolution of	gies lology Next Ger nmon sigr s	nals – Sodiu	ım.
 i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit – 2 Potassium channels, Machine Learning tec 	the biological concept the concepts of biolo development of artificities for content Number of lectures = 10 Significance, Bio Insp ructure, Cell Potential Number of lectures = 10 Number of lectures = 10 Neuron function, Cer hniques.	ots from an engineering pers gical sensing and its challer icial systems mimicking hui r developing next generation Title of the unit: Need t pired Inventions, Role of E , Action Potential, ECG and Title of the unit: Nervor ntral Nervous Systems, Ev	nges man action n technolo o study Bi Biology in d other con us System rolution of	gies lology Next Ger nmon sigr s	nals – Sodiu	ım.
 i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit – 2 Potassium channels, Machine Learning tec Unit – 3 	I the biological concept I the concepts of biolo I the concepts of biolo I development of artificities I content Number of Iectures = 10 Significance, Bio Insp ructure, Cell Potential Number of Iectures = 10 Neuron function, Cer hniques. Number of Iectures = 11	the of the unit: Nervor Title of the unit: Sensin	nges man action n technolo o study Bi Biology in d other com us System rolution of g Techniq	gies ology Next Ger nmon sign s Artificia ues	nals – Sodiu 1 Neural N	um. Jetworks,
i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit – 2 Potassium channels, Machine Learning tec Unit – 3	I the biological concept I the concepts of biolo I the concepts of biolo I development of artificities of artificities of a content Number of lectures = 10 Significance, Bio Inspondence, Bio Inspondence, Bio Inspondence, Bio Inspondence, Cell Potential Number of lectures = 10 Neuron function, Centhniques. Number of lectures = 11 Inse organs working, Sector	tes from an engineering person gical sensing and its challer icial systems mimicking hur r developing next generation Title of the unit: Need to pired Inventions, Role of E , Action Potential, ECG and Title of the unit: Nervor ntral Nervous Systems, Even Title of the unit: Sensin Sensing mechanisms, Senso	nges man action n technolo o study Bi Biology in d other com us System rolution of g Techniq	gies ology Next Ger nmon sign s Artificia ues	nals – Sodiu 1 Neural N	ım. Jetworks,
i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit – 2 Potassium channels, Machine Learning tec Unit – 3	I the biological concept I the concepts of biolo I the concepts of biolo I development of artificities of artificities of a content Number of lectures = 10 Significance, Bio Inspondence, Bio Inspondence, Bio Inspondence, Bio Inspondence, Cell Potential Number of lectures = 10 Neuron function, Centhniques. Number of lectures = 11 Inse organs working, Sector	the of the unit: Nervor Title of the unit: Sensin	nges man action n technolo o study Bi Biology in d other com us System rolution of g Techniq	gies ology Next Ger nmon sign s Artificia ues	nals – Sodiu 1 Neural N	um. Jetworks,
i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit – 2 Potassium channels, Machine Learning tec Unit – 3 Understanding of Sen Eye Comparison, elec	I the biological concept I the concepts of biolo I the concepts of biolo I development of artificities I content Number of Iectures = 10 Significance, Bio Insperior ructure, Cell Potential Number of Iectures = 10 Neuron function, Centhniques. Number of Iectures = 11 Isse organs working, Sectoric mose, electronic	ots from an engineering persigical sensing and its challendicial systems mimicking huidred developing next generation. Title of the unit: Need t pired Inventions, Role of E , Action Potential, ECG and Title of the unit: Nervor mutual Nervous Systems, Event Title of the unit: Sensing Sensing mechanisms, Sensor e tongue, electronic skin.	nges man action n technolo o study Bi Giology in d other com us System rolution of g Techniq	gies ology Next Ger nmon sign s Artificia ues ment issu	nals – Sodiu 1 Neural N ues, Digital	um. Jetworks,
i) Understand ii) Understand iii) Understand iv) Integrate bi 11. Unit wise detailed Unit-1 Life Science Studies Development, Cell Str Unit – 2 Potassium channels, Machine Learning tec Unit – 3	I the biological concept I the concepts of biolo I the concepts of biolo I development of artificities of artificities of a content Number of lectures = 10 Significance, Bio Inspondence, Bio Inspondence, Bio Inspondence, Bio Inspondence, Cell Potential Number of lectures = 10 Neuron function, Centhniques. Number of lectures = 11 Inse organs working, Sector	tes from an engineering person gical sensing and its challer icial systems mimicking hur r developing next generation Title of the unit: Need to pired Inventions, Role of E , Action Potential, ECG and Title of the unit: Nervor ntral Nervous Systems, Events Title of the unit: Sensin Sensing mechanisms, Senso	nges man action n technolo o study Bi Giology in d other com us System rolution of g Techniq	gies ology Next Ger nmon sign s Artificia ues ment issu	nals – Sodiu 1 Neural N ues, Digital	um. Jetworks,

Physiological Assist Device: Artificial Organ Development: Kidney, Liver, Pancreas, heart valves – Design Challenges and Technological Developments

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Bo	ooks Recommended		
Text I	Book		
i)	Biology for Engineers by Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W.,		
	Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, ISBN: 1121439934		
Refere	ence Books		
i)	Biology for Engineers, by Wiley Editorial (Author), January 2018, ISBN: 8126576340.		
ii)	Biology for Engineers by G. K. Suraishkumar, Oxford University Press; First edition, May 2019, ISBN: 0199498741		

1. Name of the Depart	rtment- Mechanical	Engineering				
2. Course Name	Material Engineering and Technology	L	T		P	
3. Course Code		3	(0		0
4. Type of Course (us	se tick mark)	Core (🗸)	PE ()	OE ()	EAS ()	BSC ()
5. Pre-requisite (if any)	Chemistry at +2 Level	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Number of I	Lectures, Tutorials, P	Practical (assuming 14 w	eeks of one	semester	•)	1
Lectures = 42		Tutorials = 0	Practica	$\mathbf{l} = 0$		
8. Course Description	n					
This introductory cours	e combines the acade	mic disciplines of chemis	try, physics	and eng	ineering to	create a

This introductory course combines the academic disciplines of chemistry, physics, and engineering to create a MST curriculum. The course covers the fundamentals of ceramics, glass, metals, polymers, and composites. Designed to appeal to a broad range of students, the course combines hands-on activities, demonstrations and long-term student project descriptions. The basic philosophy of the course is for students to observe, experiment, record, question, seek additional information, and, through creative and insightful thinking.

9. Learning objectives:

- i) The main objective of this course is to provide the basic knowledge needed to explore the discipline of materials science and engineering.
- ii) To develop the knowledge of how the structure of materials is described technically.
- iii) To develop the knowledge of how the properties of materials are described and how material failure is analyzed.
- iv) To introduce the concepts of structure-property.
- v) To develop knowledge in various class of materials and their applications.

10. Course Outcomes (COs):

- i) Understand how materials are formed and their classification based on atomic arrangement.
- ii) Describe the mechanical behaviour of metallic systems and its importance.
- iii) Evaluate system for fatigue failures.
- iv) Gain knowledge on different classes of materials and their applications.

11. Unit wise detailed content

Unit-1	Number of	Title of the unit: Crystal Structure and their Imperfections
	lectures = 10	

Introduction to materials science – Primary and Secondary bonding in materials- Crystalline and amorphous materials –Single crystal and polycrystalline materials – Space Lattice-Module cell –Crystal systems – Bravais Lattice- Miller indices – Closed packed structures- Principal Metallic crystal structures, stacking sequence and stacking faults, classification of crystal defects- Point, Line, surface and volume, Edge & Screw dislocation, Effect of imperfection on material properties, Numerical Problems on crystallography.

Unit – 2	Number of	Title of the unit: Phase Diagram
	lectures = 11	

Basics of Solidification mechanism – Cooling curve of pure metal and alloy – Phase –Phase Diagram–Gibbs's Phase rule – Interpretation of mass fractions using Lever's rule, Binary Iso-morphous system, Binary Eutectic alloy system (Lead-Tin System) –Binary Peritectic alloy system (Iron-Nickel System) – Invariant reactions – Iron-Iron carbide phase diagram- Slow cooling of Hypo and hyper eutectoid steels – Temperature-Time-Transformation (TTT) and Continuous Cooling Transformation(CCT) Diagrams – Effect of alloying elements in steel – types of stainless steel and cast iron

Unit – 3	Number of	Title of the unit: Heat Treatment
	lectures = 11	

Heat Treatment, Annealing and its types, Normalizing, Hardening tempering, Aus-tempering and Mar- tempering, Microstructure observation, Surface Heat treatment processes, Carburizing, Nitriding, cyaniding, carbonitriding, flame and induction hardening. Composites, Fiber reinforced, Metal Matrix, Ceramic Matrix, properties and applications; Ceramics, Alumina, Zirconia, Silicon Carbide, Sialons, Reaction Bonded Silicon Nitride (RBSN), Glasses, properties and applications, Magnetic materials.

Unit – 4	Number of	Title of the unit: Mechanical Properties of Materials and
	lectures = 10	Testing

Mechanical properties of materials, Strengthening mechanism, Plastic deformation of single and poly-crystalline materials, Effect of Slip and twinning, Stress-strain curves of various ferrous and non-ferrous metals, Engineering stress strain, true stress strain relations, problems, Tensile test of ductile material, properties evaluation- Hardness measurement tests, Fracture of metals, Ductile and Brittle fracture; Fatigue, Endurance limit of ferrous and non-ferrous metals, Fatigue test ; Creep and stress rupture, mechanism of creep, stages of creep and creep test, SEM, XRD.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) O.P. Khanna, Material Science, Dhanpat Rai Publication House, New Delhi, 2012, ISBN: 8189928392

Reference Books

- i) V. Raghavan. Materials Science and Engineering, PHI; Fifth edition (30 July 2011), ASIN: B00K7YGKWQ
- **ii**) William D. Callister, David G. Rethwisch, Fundamentals Of Materials Science And Engineering: An Integrated Approach, John Wiley & Sons; 4th Edition edition (8 December 2011), ISBN: 1118061608
- iii) William F. Smith and Javad Hashemi (2004), Foundations of materials science and engineering 5th Edition, Mc Graw Hill, 2009, ISBN: 9780073529240

2.	Course Name	Basic of Mechanical Engineering Lab	L		Т		P
3.	Course Code		0		0		2
4.		urse (use tick mark)	Core (✓)	PE ()	BSC	OE ()	EAS 0
5.	Pre- requisite (if any)	Physics at +2 Level	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
		er of Lectures, Tutorials	s, Practical (assuming 14 week			r)	
Lect	ures = 0		Tutorials = 0	Practi	cal = 28		
8.	Course Desc	cription					
i) The course i) The course	e aims to deal with the con			1g system	n and turbi	ines
i i 10 i i i) The course i) The course ii) The course iii) The course ii) The course ii) Course Oute ii) Acquire kr ii) Acquire kr 	e aims to deal with the con e aims to deal with the con e aims to deal with the con e aims to deal with the con comes (COs): After the con nowledge of boilers and ac nowledge of engines.	acept of engines. Acept refrigeration system, air concept of velocity Ratio and Efficient completion of the course, the stud	onditionin eiency of dent shall nd turbine	wheels a l be able	ind screw j	
i i 10 i i i i) The course i) The course ii) The course iii) The course ii) The course ii) Course Oute ii) Acquire kr ii) Acquire kr 	e aims to deal with the com e aims to deal with the com e aims to deal with the com e aims to deal with the com comes (COs): After the com nowledge of boilers and ac nowledge of engines. nowledge refrigeration system nowledge of velocity Ratio	acept of engines. acept refrigeration system, air concept of velocity Ratio and Efficient completion of the course, the stu- accessories.	onditionin eiency of dent shall nd turbine	wheels a l be able	ind screw j	
i i 10 i i i 11) The course i) The course ii) The course ii) The course v) The course course Oute course Oute course Quire kr i) Acquire kr ii) Acquire kr v) Acquire kr v) Acquire kr 	e aims to deal with the com e aims to deal with the com e aims to deal with the com e aims to deal with the com comes (COs): After the com nowledge of boilers and ac nowledge of engines. nowledge refrigeration system nowledge of velocity Ratio	acept of engines. acept refrigeration system, air concept of velocity Ratio and Efficient completion of the course, the stu- accessories.	onditionin eiency of dent shall nd turbine	wheels a l be able	ind screw j	jack
i i 10 i i i 11) The course i) The course ii) The course ii) The course v) The course course Oute course Oute course Quire kr i) Acquire kr ii) Acquire kr v) Acquire kr v) Acquire kr 	e aims to deal with the com e aims to deal with the com e aims to deal with the com e aims to deal with the com comes (COs): After the com nowledge of boilers and ac nowledge of engines. nowledge refrigeration system towledge of velocity Ration t Title	acept of engines. acept refrigeration system, air concept of velocity Ratio and Efficient completion of the course, the stu- accessories.	onditionin eiency of dent shall nd turbine	wheels a l be able	to	ered
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i i 10 i i i 11) The course i) The course ii) The course v) The course . Course Oute . Course Oute . Acquire kr i) Acquire kr i) Acquire kr v) Acquire kr . Lab Conten No. 1 2	e aims to deal with the com e aims to deal with the com e aims to deal with the com e aims to deal with the com comes (COs): After the com nowledge of boilers and ac nowledge of engines. nowledge refrigeration system to study the cochran and To Study the working and boilers.	d Babcock & Wilcox boilers.	onditionin eiency of dent shall nd turbine screw jac	wheels a l be able s k	to CO cove	ered
i i 10 i i i i) The course i) The course ii) The course v) The course v) The course v) The course v) Acquire kr i) Acquire kr ii) Acquire kr v) Acquire kr v) Acquire kr ii) Acquire kr iii) Acquire kr	e aims to deal with the com e aims to deal with the com e aims to deal with the com e aims to deal with the com comes (COs): After the com nowledge of boilers and ac nowledge of engines. nowledge refrigeration system to write the contract of the contract To Study the Cochran and boilers. To study the working and	d Babcock & Wilcox boilers.	onditionin eiency of dent shall nd turbine screw jac	wheels a l be able s k	CO cove	ered
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7	To study the constructional features and working of Pelton wheel	iii)
	Turbine, Francis Turbine and Kaplan Turbine.	
8	To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.	iv)
9	To study simple screw jack and compound screw jack and determine their efficiency.	iv)
10	To find the Mechanical Advantage, Velocity Ratio and Efficiency of a Differential Wheel & Axle.	iv)

Name	se	Metrology and Material Engineering Lab	L		Τ	Р	
3. Cours Code	se		0		0	2	2
	of Cour	se (use tick mark)	Core (✓)	PE ()	BSC 0	OE ()	EAS 0
5. Pre- requis any)	site (if	Physics at +2 Level	6. Frequency (use tick marks)	Even O	Odd (✔)	Either Sem ()	Every Sem ()
7. Total	Numbe	r of Lectures, Tutorial	s, Practical (assuming 14 week	s of one	semeste	r)	
Lectures = (0		Tutorials = 0	Practi	cal = 28		
8. Cours	se Descr	iption					
i)	The mai	n objective of this cours	se is to provide the basic knowle	dge need	ed to exp	olore the	
ii) iii) iv)	disciplin To deve Inspecti Design their use	ne of materials science a lop the knowledge of ho on of engineering parts of part, tolerances and fir es. Evaluation and inspe-	nd engineering. ow the structure of materials is of with various precision instruments. To know the principles of me ction of surface roughness.	lescribed nts. easuring i	technica nstrumer	lly. nts and gau	iges and
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ii) iii) iv) 10. Cours i) ii) ii)	disciplin To deve Inspecti Design their use se Outco Underst Describ Students the stan	the of materials science a lop the knowledge of ho on of engineering parts of part, tolerances and fit es. Evaluation and inspe- tomes (COs): After the c and how materials are for the mechanical behavit s will be able to design t	nd engineering. ow the structure of materials is of with various precision instruments. To know the principles of me ction of surface roughness. ompletion of the course, the stup primed and their classification ba	lescribed nts. easuring i dent shall used on at mportanc roduct qu	technica nstrumer be able omic arr ce. ality. Th	lly. nts and gau to angement. ey can und	derstanc
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ii) iii) iv) 10. Cours i) ii) ii) iii) iii) 11. Lab C Sr. No.	disciplin To deve Inspecti Design of their use se Outco Underst Describ Students the stan parts wi The qua Content	he of materials science a lop the knowledge of he on of engineering parts y of part, tolerances and fit es. Evaluation and inspe- omes (COs): After the c and how materials are for the mechanical behavit s will be able to design t dards of length, angles, t th various comparators. lity of the machine tool	nd engineering. by the structure of materials is of with various precision instruments. To know the principles of me- ction of surface roughness. ompletion of the course, the stu- bormed and their classification ba- our of metallic systems and its in- olerances and fits for selected particles and the evaluating with alignment test can also be nould for small metallic speciments for micro structural examination	lescribed nts. easuring i dent shall used on at mportance roduct qu on of surf evaluated en.	technica nstrumen l be able omic arr re. lality. Th Face finis	lly. Its and gau to angement. ey can und h and mea 1 CO cove i)	derstand isure the ered
ii) iii) iv) 10. Cours i) ii) ii) iii) iii) 11. Lab C Sr. No.	disciplin To deve Inspecti Design of their use se Outco Se Outco Underst Describ Students the stan parts wi The qua Content	he of materials science a lop the knowledge of he on of engineering parts y of part, tolerances and fit es. Evaluation and inspe- omes (COs): After the c and how materials are for the mechanical behavi s will be able to design t dards of length, angles, t th various comparators. lity of the machine tool Citle Preparation of a plastic n Preparation of specimen grinding, polishing, etchi	nd engineering. by the structure of materials is of with various precision instruments. To know the principles of me- ction of surface roughness. ompletion of the course, the stu- bormed and their classification ba- our of metallic systems and its in- olerances and fits for selected particles and the evaluating with alignment test can also be nould for small metallic speciments for micro structural examination	lescribed hts. easuring i dent shall used on at mportance roduct qu on of surf evaluated en. n-cutting,	technica nstrumen be able omic arr re. aality. Th face finis	lly. Its and gau to angement. ey can und h and mea 1 CO cove i)	derstand sure the ered

4	Experiments on heat treatment such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after heat treatment.	ii)
5	Study of corrosion and its effects.	ii)
6	Determination of grain size for a given specimen.	ii)
7	Study the working of simple measuring instruments- Vernier calipers, micrometer, tachometer.	iii), iv)
8	Measurement of effective diameter of a screw thread using 3 wire method.	iii), iv)
9	Study & angular measurement using level protector.	iii), iv)
10	Measurement of angle using sine bar & slip gauges.	iii), iv)
11	Study of limit gauges.	iii), iv)

2. Cour	se Name	Workshop Technology Lab	L		Τ	Р	•
3. Cour	se Code		0		0	2	'
4. Туре	e of Course	e (use tick mark)	Core (✓)	PE ()	EAS 0	OE ()	BSC 0
5. Pre-ı (if ar	requisite ıy)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Ever y Sem ()
7. Tota Lectures		of Lectures, Tutorials,	Practical (assuming 14 weeks Tutorials = 0	1	mester) cal = 28		
	se Descrip			Tacu	cai – 20		
iii) 7 iv) 7 10. Cour i) A ii) A iii) A	The course of th	aims to deal with the cor aims to deal with the cor nes (COs): After the cor owledge of Lathe, Shape owledge of surface grind owledge of joints	ncept of joint using Electric Ard npletion of the course, the stud- r, and Milling machine. er and drilling machine.	c Welding			
IV) A	•	owledge of joint using El	lectric Arc welding				
11. Lau		D* /1				СО	
Sr. No.		ſitle				cove	red
Sr. No. 1			perations like turning, step turn	ing, thread	ling etc. o		red i)
	î	Fo perform machining op he Lathe.	perations like turning, step turn ece by using Milling Machine.	ing, thread	ling etc. o		
1	ן t	To perform machining op he Lathe. To make slot on work pic			ding etc. o		i)
1	1 t 1	To perform machining of he Lathe. To make slot on work pie To prepare groves on wo	ece by using Milling Machine.	ine.	ling etc. o		i) i)
2	1 1 1 1 1 1	To perform machining of he Lathe. To make slot on work pie To prepare groves on wo	ece by using Milling Machine. rk piece by using Shaper Mach ning operation on Surface Grino	ine.	ding etc. o	on	i)i)

7	To make butt joint	iii)
8	To make male and female joint.	iii)
9	To make Lap joint by using Electric Arc Welding.	iv)
10	To make butt joint by using Electric Arc Welding	iv)

	Mana Nama		Engineering L	Т		Р	
2. Cou	rse Name	Engineering		I		r	
		Graphics and					
		Design Lab					
2 0	C. I.		0	0		2	
3. Cou	rse Code		0	0		2	
4. Тур	e of Course (u	se tick mark)	Core (✓)	PE ()	EAS ()	OE ()	BSC ()
5. Pre-	requisite (if	Geometry and	6. Frequency (use	Even	Odd	Either	Every
any)	-	Drawing at +2	tick marks)	0	(✔)	Sem ()	Sem ()
		Level		Ŭ,		~	Č.
7. Tota	al Number of I	Lectures, Tutorials,	Practical (assuming 14	weeks of	one semes	ter)	
Lecture			Tutorials = 0		cal = 28	,	
S. Cou	rse Descriptio	n					
Engineer	ring Graphics	and design is conside	red as language of engir	neers This	course is	introduce	to provid
•	e .	e e	ing aspects in engineerin				•
	•		• •	0 11		•	
-		-	s of introduction to com	-	-		
lanes a	nd solids. Towa	ards the end of the co	ourse, it is expected that s	students w	ould be m	atured to v	visualize tl
ngineer	ring component	ts from any drawing	sheet, followed by the p	rojection (echniques.	A numbe	er of chose
roblem	s will be solved	to illustrate the conc	cepts clearly.				
	rning objective						
i) '	To understand	the basic concepts of					
i) ii)	To understand To develop the	the basic concepts of skills of reading & ir	nterpretation of Engineer	ing Drawi	ng.		
i) ii) iii)	To understand To develop the To construct th	the basic concepts of skills of reading & ir e basic and intermedi	nterpretation of Engineer ate geometry.	ing Drawi	ng.		
i) ' ii) ' iii) ' iv) '	To understand To develop the To construct th To develop the	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th	nterpretation of Engineer	ing Drawi	ng.		
i) ' ii) ' iii) ' iv) ' 10. Cou	To understand To develop the To construct th To develop the rse Outcomes	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs):	nterpretation of Engineer ate geometry. e engineering drawing.	_			
i) ' iii) ' iii) ' iv) ' l0. Cou i)	To understand To develop the To construct th To develop the irse Outcomes Understand the	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru	nterpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning	g of given			
i) ' ii) ' iii) ' iv) ' l0. Cou i) ii)	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and u	nterpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method	g of given s.	drawing.		
i) ' ii) ' iii) ' iv) ' 10. Cou i) ii) iii)	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using	nterpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method ng projection of lines, pla	g of given s.	drawing.		
i) ii) iv) iv) 10. Cou i) ii) iii) iii) iv)	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using	nterpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method	g of given s.	drawing.		
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i) ii) iv) iv) 10. Cou i) ii) iii) iii) iv) 11. Lab	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title	the basic concepts of skills of reading & ir e basic and intermedi <u>skills of preparing th</u> (COs): use of drawing instru- ualization skills and use different views using vertices and curves to	nterpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method ng projection of lines, pla	g of given s.	drawing.	СО	Covered i), ii)
i) iii) iv) iv) 10. Cou i) ii) iii) iii) iv) 11. Lab Sr. No.	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title Different typ	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using ertices and curves to pes of lines with illus	tration and application.	g of given s. anes and s	drawing. olids.		i), ii)
i) iii) iv) iv) i0. Cou i) ii) iii) iii) iii) iv) 11. Lab Sr. No.	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, vince the Use of edges, vince the Use of Different type Use of Draw	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using vertices and curves to pes of lines with illust ving instruments and	nterpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method ng projection of lines, pla construct the drawing.	g of given s. anes and s	drawing. olids.		
i) ii) iii) iv) l0. Cou i) ii) iii) iii) iii) iii) iii) iv) l1. Lab Sr. No. 1	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, vince the Use of edges, vince the Use of Different type Use of Draw	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using ertices and curves to pes of lines with illus	tration and application.	g of given s. anes and s	drawing. olids.		i), ii)
i) iii) iv) iv) iv) i0. Cou i) ii) iii) iii) iii) iii) iii) iii)	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title Different typ Use of Draw dimensionin	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using vertices and curves to pes of lines with illust ving instruments and	terpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method ng projection of lines, pla construct the drawing. tration and application. understand the design sh	g of given s. anes and s	drawing. olids.		i), ii)
i) ii) iii) iv) l0. Cou i) ii) iii) iii) iii) iii) iii) l1. Lab Sr. No. 1 2	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title Different typ Use of Draw dimensionin	the basic concepts of skills of reading & ir e basic and intermedi <u>skills of preparing th</u> (COs): use of drawing instru- ualization skills and use different views using rertices and curves to pes of lines with illust ving instruments and using and lettering.	tration and application. understand the design sh understand the design sh understand the design sh	g of given s. anes and s	drawing. olids.		i), ii) i)
i) ii) iii) iv) i0. Cou i) ii) iii) iii) iv) 11. Lab Sr. No. 1 2 3 4	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title Different typ Use of Draw dimensionin Applications	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using vertices and curves to pess of lines with illus ving instruments and use and lettering. s of drawing command f points in all the four	terpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method ng projection of lines, pla construct the drawing. tration and application. understand the design sh ads in AutoCAD. r quadrants.	g of given s. anes and s eet layout	drawing. olids. with		i), ii) i) i) ii)
i) ii) iii) iv) 10. Cou i) ii) iii) iii) iii) iii) iii) iii) 11. Lab 5r. No. 1 2 3	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title Different typ Use of Draw dimensionin Applications Projection o	the basic concepts of skills of reading & ir e basic and intermedi <u>skills of preparing th</u> (COs): use of drawing instru- ualization skills and the different views using vertices and curves to pes of lines with illust ving instruments and the g and lettering. s of drawing command f points in all the four f straight lines paralle	tration and application. understand the design sh understand the design sh understand the design sh	g of given s. anes and s eet layout	drawing. olids. with		i), ii) i) i)
i) ii) iii) iv) i0. Cou i) ii) iii) iii) iv) 11. Lab Sr. No. 1 2 3 4	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title Different typ Use of Draw dimensionin Applications	the basic concepts of skills of reading & ir e basic and intermedi <u>skills of preparing th</u> (COs): use of drawing instru- ualization skills and the different views using vertices and curves to pes of lines with illust ving instruments and the g and lettering. s of drawing command f points in all the four f straight lines paralle	terpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method ng projection of lines, pla construct the drawing. tration and application. understand the design sh ads in AutoCAD. r quadrants.	g of given s. anes and s eet layout	drawing. olids. with		i), ii) i) i) ii)
i) ii) iii) iv) i0. Cou i) ii) iii) iii) iv) 11. Lab Sr. No. 1 2 3 4	To understand To develop the To construct th To develop the rse Outcomes Understand the Acquire the vis Able to draw th Use of edges, v Content Title Different typ Use of Draw dimensionin Applications Projection o and traces o	the basic concepts of skills of reading & ir e basic and intermedi skills of preparing th (COs): use of drawing instru- ualization skills and use different views using ertices and curves to pes of lines with illust ving instruments and use and lettering. s of drawing command f points in all the four f straight lines paralled f lines.	terpretation of Engineer ate geometry. e engineering drawing. uments and dimensioning use of projection method ng projection of lines, pla construct the drawing. tration and application. understand the design sh ads in AutoCAD. r quadrants.	g of given s. anes and s eet layout d to projec	drawing. olids. with		i), ii) i) i) ii)

7	Projection of cones and solid cylinders with axes parallel, perpendicular and inclined to both the reference planes.	iii), iv).
8	Projection of prisms and pyramids with axes parallel, perpendicular, inclined to both the reference planes.	iii), iv).
10	Design Orthographic projection of simple machine elements and engineering drawings.	iv)
11	Design Isometric projection of simple machine elements and engineering drawings.	iv)
12	Design Sectional views of simple machine elements and engineering drawings.	iv)

2nd Semester

2.	Course Name	Applied Physics	L	Т		Р	
			3	0		0	
3.	Course Code						
4.	Type of Course	e (use tick mark)	Core (🗸)	PE ()	EAS ()	OE ()	BSC (✓)
5.	Pre-requisite (if any)	Physics at +2 Level	6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tutorials,	Practical (assuming 14 we	eks of one	semester)		
Lectures = 42			Tutorials = 0	Practical = 0			
app	ply these concepts	s in today's rapidly chan	ortunity to students to learn for ging and highly technical/en odern scientific principles.		-		

- i) An ability to apply profound understanding of Quantum Mechanics and its applications.
- ii) An understanding of Optics, Dielectric and Super conductivity.
- iii) An ability to design a Laser system and its component, or process to meet desired needs within realistic constraints such as health and safety, manufacturability
- iv) The broad education necessary to understand special theory of relativity.

10. Course Outcomes (COs): At the completion of this course, students will be able to:

- i) Students would be able to describe the Quantum Mechanics and its applications.
- ii) Students would be able to write down the band theory of Solids.
- iii) To enable student to learn and to apply concepts learnt in Quantum optics in Industry and in real life.
- iv) To identify the applications of Dielectric and Super Conductors.

11. Unit wise detailed content

Unit-1	Number of	Title of the unit: Interference and Diffraction
0111-1	Number of	The of the unit: Interference and Diffraction
	lectures = 11	

Interference: Coherent sources, conditions for sustained interference. Division of Wave-Front - Fresnel's Biprism, Division of Amplitude- Wedge-shaped film, Newton's Rings, Michelson Interferometer, applications (Resolution of closely spaced spectral lines, determination of wavelengths, determination of refractive indices of the medium).

Diffraction: Difference between interference and diffraction, Fraunhofer and Fresnel diffraction. Fraunhofer diffraction through a single slit, Plane transmission diffraction grating, absent spectra, Rayleigh criterion of resolution, dispersive power and resolving power of grating.

Unit - 2	Number of	Title of the unit: Polarization and Special Theory of	
	lectures = 10	Relativity	

Polarization: Polarized and unpolarized light, uniaxial crystal, double refraction, Nicol prism, Quarter and Half wave plates, Detection and production of different types of polarized light, polarimetry, optical and specific rotation, Biquartz& Laurent's half shade polarimeter.

Special Theory of Relativity: Michelson's Morley Experiment, Postulates of special theory of relativity, Lorentz transformations. Consequences of LT (length contraction and time dilation). Addition of velocities, variation of mass with velocity, Mass energy equivalence.

Unit - 3	Number of	Title of the unit: Laser and Fiber Optics
	lectures = 10	

LASER: Spontaneous and Stimulated emission, Laser action, characteristics of laser beam-concept of coherence, spatial and temporal coherence, He-Ne, Ruby Laser and semiconductor lasers (simple ideas), applications.

Fiber Optics: Propagation of light in optical fibers, numerical aperture, V-number, single and multimode fibers, attenuation, dispersion, applications.

Unit - 4	Number of	Title of the unit: Dielectrics and Superconductivity
	lectures = 11	

Dielectrics: Molecular theory, polarization, displacement vector, electric, Susceptibility, dielectric coefficient, permittivity & various relations between them, Gauss's law in the presence of a dielectric, Energy stored in a uniform electric field, concept of local molecular fields and Classius-Mossotti relation.

Superconductivity: Introduction (Experimental survey), Meissner effect, London equations, Hard and Soft superconductors, Elements of BCS Theory.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books	Recommended
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Text Book i) Modern Physics for Engineers – S.P.Taneja (R. Chand)
i) Modern Physics for Engineers – S.P.Taneja (R. Chand)
Reference Books
i) Engineering Physics – Satya Prakash (PragatiPrakashan)
ii) Modern Engineering Physics – A. S. Vasudeva (S. Chand)
iii) Perspectives of Modern Physics - Arthur Beiser (TMH)
iv) Optics – Ajoy Ghatak (TMH)
v) Fundamentals of Physics – Resnick & Halliday (Asian Book)

	f the Department- Mechan	ical Engineering				
2. Course Name	Engineering Thermodynamics	L	Т	Р		
3. Course Code		3	0	0		
4. Type of	Course (use tick mark)	Core (✓)	PE ()	OE	0	
5. Pre- requisi te (if any)	+2 Level Physics and Chemistry	6. Frequency (use tick marks)	(✔)	ld () Either Sem ()	5	
	umber of Lectures, Tutori	· · ·				
Lecture	es = 42	Tutorials = 0	Practical	= 0		
iv) To u 10. Course i) i) Difference ii) App	nalyze the performance of the nderstand the ideal gas mixt Outcomes (COs): On comp erentiate between closed and by the concept of second law yze the performance of	ures. Deletion of this course, to open systems and ana to design thermodyna	he students wi lyze related pr mic systems.	ll be able to oblems.	ds to improve	
iii) Ana	•	Barris I I I I	, i j i i i i		r	
therr	nodynamic performance.					
therr iv) Solv	e problems of combustion se detailed content					
therr iv) Solv	e problems of combustion	Title of the unit: Fi	rst Law of Th	ermodynamics		
therr iv) Solv 11. Unit wi Unit-1 Basic conc system - St and Zeroth	e problems of combustion se detailed content Number of lectures =	hermodynamics and E ses and cycles, Forms at law of thermodynamices	nergy, Closed of energy, Wo nics, Energy ba	and open systems, ork and heat transfe lance for closed sy	er, Temperature ystems, first law	
therr iv) Solv 11. Unit wi Unit-1 Basic conc system - St and Zeroth applied to s Unit – 2	e problems of combustion se detailed content Number of lectures = 10 epts of Thermodynamics, Thate and equilibrium, Process law of thermodynamics, first steady, flow engineering dev	hermodynamics and E ses and cycles, Forms at law of thermodynamices Title of the unit: Se	nergy, Closed of energy, Wo nics, Energy ba econd Law of	and open systems, ork and heat transfo lance for closed sy Thermodynamics	er, Temperature estems, first law	

TI '4 0		
Unit – 3	Number of lectures = 11	Title of the unit: Vapour and Gas Power Cycles
Proportion		liagram for phase, change processes, Carnot vapour cycle, Rankine
-		eles, Analysis of power cycles, Carnot cycle, Conditions for exact
•		ron equation, Joule-Thompson coefficient and Inversion curve
Unit - 4	Number of lectures =	Title of the unit: Ideal Gas Mixtures
0 mt – 4	10 $10 \text{ for fectures} =$	The of the unit. Ideal Gas Wixtures
Ideal and r	eal gases, Vander Waals equ	uation, Principle of corresponding states, Ideal gas equation of state -
Other equa	tions of state, Compressibil	ity factor, Evaluating internal energy, enthalpy, entropy and specific
heats.		
12. Brief D	escription of self-learning /	'E-learning component
http://sgtlms. Journal pape	rs; Patents in the respective f	field.
	Recommended	
Text Book		
	• • • • • •	ermodynamics, Tata McGraw-Hill Publishing Company Ltd., ISBN
	0-070-15131-4	
Reference B		
	• •	ics: An Engineering Approach, Tata McGraw-Hill Publishing
	pany Ltd., ISBN 978-0-073-	
,	Arora, Thermodynamics, Ta	ata McGraw- Hill Publishing Company Ltd., ISBN 978-0-074-62014-
4.		

2.	Course	Advance	L		Т		Р	
	Name	Graphics						
		and Design						
3.	Course		2		0		0	
	Code							
4. Type of Course (use tick Core (✓)				EAS ()	PE ()		OE () BSC ()	
	mark)							
5.	Pre-	Geometry		Frequency	Even	Odd	Either Sem ()	Every Sem ()
	requisite	and		(use tick	(✔)	0		
	(if any)	Drawing at		marks)				
		+2 Level				<u> </u>		
7.		ber of Lectures			<u> </u>			er)
	$\frac{\text{res} = 28}{\text{D} \cdot 65}$		Tutorials =	0	Practi	cal = 0		
8. Enging	Brief Syllab		a languaga of	anaina ana Th		ia thua	introduced to m	morrido odreance
		g is considered th						
	U	damentals of eng	, U	0				0.
		use of drawing i sound knowledge						
	•	ied in drafting ar	-			-		-
		industry, constru		-	ne may		to work in uni	erent helds such
	Learning ob		etton maastry	ete.				
i)	-	primary knowled	ge of working	drawing				
ii)		orthographic drav			arts usin	g Solid	works software	بد
,	•	skill to produce a	•			5 Dona	works soreware	
iv)		skill to produce d	•	•		rom as	sembly drawing	<u>o</u> .
10.		comes (COs):		8	I			
 i)		conventional rep	presentation o	f materials: co	ommon n	nachine	e elements and p	parts such as
,	-	bolts, webs etc.						
ii)	Knowledge of	of types of sectio	ns – selection	of section pla	ines and	drawin	g of sections an	ıd
		tional views. Par					0	
iii)) Knowledge (of methods of dir	nensioning, g	eneral rules fo	or sizes a	nd plac	ement of dimer	nsions for holes,
	centers, curv	ed and tapered for	eatures			_		
iv)) Knowledge	of types of Draw	ings – working	g drawings fo	r machin	e parts.		
11.	Unit wise de	etailed content						
Unit-1		Number of	Title of the	unit: Introdu	ction to	Solid V	Works and pro	jection of views
		lectures = 7						
Introdu	uction to Solid	Works software	and drafting o	n it. Represer	tation of	differe	nt materials, lik	ke - ferrous, non-
		s, wood. Limits					÷	
		, additional viev						
		forms of Screw the						Cotter joints and
knuckl	le joint; Rivete	d joints for plate						
Unit –	- 2	Number of	Title of the	unit: Drawin	g differe	ent sha	pes	
		lectures = 7						
		es of rivet heads						
		and butt joint, z	1gzag and cha	ın structure, B	oiler joi	nt. (All	drawings to be	completed using
	Works softwar	./) F -		
Unit –	- 3	Number of	Title of the	unit: Drawin	g Nuts &	k Bolts		
		lectures = 7						
		s, terminology u		÷			• •	
	iew, front view ead diameter.	v and side view)	ot a bolt, Imp	erical relation	is of dim	ensions	s of nut and bol	It with respect t
1 1. 1								

Unit – 4	Number of	Title of the unit: Joints, Bearing and Engine parts.					
	lectures = 7						
Principles of Isometr	ic Projection -	Isometric Scale - Isometric Knuckle joint, coupling, (any one coupling)					
bearing (any one bear	ring), Internal Co	ombustion Engine parts.					
12. Brief Descri	. Brief Description of self-learning / E-learning component						
The students will be	The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures						
delivered by subject of	experts of SGT U	Jniversity.					
The link to the E-Lea	rning portal.						
http://sgtlms.org							
Journal papers; Pater	its in the respect	ive field.					
13. Books Recor	nmended						
Text Book							
i) Machine Draw 0198070771	ing by Bhattach	arya, Oxford University Press; Illustrated edition. ISBN : 978-					
Reference Books							
i) Drawing and I 1585038459	Detailing with So	blidWorks by David Planchard, SDC Publications; 1st edition. ISBN: 78-					
ii) Machine Draw	ing hy Ajaat Sir	ngh, McGraw Hill Education; 2nd edition. ISBN: 978-0071072946					

iii) Engineering Drawing – M.B. Shah and B.C. Rana, Pearson, 2005, ISBN: 9788129712301

2.	Course Name	Basics of Automobile Engineering		L		Т		Р
3.	Course Code			3		0		0
4.	Type of	Course (use tick mark)		Core (✓)	PE ()		OE ()	
5.	Pre- requisi te (if any)	NA	6.	Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sen ()
7.	Total Nu	mber of Lectures, Tutori	als, P	ractical (assumi	ng 14 wee	ks of one	semester)	
	Lectures	= 42	Tut	orials = 0	Practi	ical = 0		

The Automobile Engineering provides in depth knowledge of vehicle engineering, incorporating elements of mechanical, electrical, electronics, software and safety engineering it is applied to the design, manufacture and operation of motorcycle, automobile, buses and trunks and their respective engineering subsystem.

9. Learning objectives:

- i) To develop knowledge on basic concepts of Automotive Chassis.
- ii) To develop knowledge on Automobile systems concerning control of vehicles.
- iii) To develop knowledge on understanding and improving the performance of Automobile chassis system.
- iv) To develop knowledge on understanding the Steering mechanism and power steering.

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Understand construction, working and functions of Automobile body & chassis.
- ii) Understand construction, working and functions of Automobile control systems such as steering.
- iii) Understand the modern trend of technological developments of chassis frame, body engineering & steering systems.
- iv) Understand the concept of body engineering.

11. Unit wise detailed content

110 01110 1115						
Unit-1	Number of lectures = Title of the unit: Vehicle Layout and Frames					
	10					
Vehicle lay	Vehicle layout, Definition of an automobile, layout of a vehicle. Layout of the front engine rear wheel driven					
vehicle, and explain location and function of major vehicle components and systems in brief. Classification &						
comparison of vehicle layout with respect to i) Location of engine, ii) No of live axles, iii) Arrangement of						
Engine, Passenger and Luggage section, iv) Application. & Comparison. Chassis Frames: Introduction -						
Necessity of frame and its functions. Loads acting on frame. Types of frames- conventional (ladder and x-						
member type), semi-integral and integral types. Frame sections-channel, box and tubular sections, back bone						
type Chassi	s frame, Materials of frames	. Sub frame, Defects in frames.				

Unit – 2	Number of lectures =	Title of the unit: Body Engineering
	10	

Types of bodies and materials used in body construction. Protective and anticorrosive treatments, painting and repainting procedure. Effect of stream lining [aerodynamic shape] on vehicles' performance. Comparison between Integral body and Framed Construction

Unit – 3	Number of lectures =	Title of the unit: Steering system
	11	

Steering linkages & Steering column. Steering geometry and its effects – Caster, camber, king pin inclination, toe in- toe out, Correct Steering angle, suspension height & it's effects on stability, steering effort & vehicle control etc. Understeering and oversteering, Turning radius & it's effects. Tilt & Telescoping steering wheels, Collapsible steering column, construction & working Principle. Construction, working and application of Steering gear box – Rack and Pinion type, Recirculating ball type, Worm and Roller type. Ackerman Principle and linkage. Defects & Troubleshooting.

Unit – 4	Number of lectures =	Title of the unit: Power Steering
	11	

Principles of Power Steering. Comparison between Conventional Steering System and Power Steering System. Power Steering System Types (Hydraulic and electrical) Construction and working principle of different power steering system, Power Steering Pumps, Four Wheeled Steering. Power Steering System – Troubleshooting.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.
13. Books Recommended
Text Book
ii) Dr. Kirpal Singh, Automobile Engg. Vol1, Standard Publishers
Reference Books
iii) R.B. Gupta Automobile Engineering Satya Prakashan
iv) Crouse & Angline Automotive Mechanics Tata McGraw Hill
v) Joseph Heitner Automotive Mechanics East West Press, New Delhi

2.	Course Name	Probability and Statistics	L		Т]	Р
3. Course Code			3		0		0
4.	Type of Course (use	e tick mark)	Core ()	PE ()	OE ()	EAS ()	BSC (✓)
5.	Pre-requisite (if any)	Maths at +2 Level	6. Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Number of L	ectures, Tutorials, P	ractical (assuming 14 we	eks of one	e semester	·)	1
Le	ctures = 42		Tutorials = 0	Practic	al = 0		
8.	Course Description						
	 their applica To serve as Statistical te To understanti To understanti Expose studition Course Outcomes (1000) i) Basics of Praticity ii) Sampling the iii) Various tests	exposure to the studention. a foundation to analisting Method. ad the Tests of Hypothents to Correlation and COs): On completion obability distributions eory and Theory of Ess s of Hypothesis and S	of this course, the studer stimation.	e and Eng	ineering a	pplications	
	-						
	Unit wise detailed c it-1	ontent Number of	Title of the unit: Proba	ahility Die	tributions	1	
UII		lectures = 10		Junity Dis			
Var dist cor	riance of Probability	 distribution, Stand density function, Cur Uniform, Normal, E Number of 	ables, Probability Distril ard discrete distribution nulative distribution funct exponential, Joint distribu Title of the unit: Samp	is: Binom tion, Expection and Jo	ial, Poiss ctation and pint density	on and C Variance, functions	eometrie Standare
		lectures = 11					

population parameters, Confidence intervals for variance of a Normal distribution, Maximum likelihood estimates.

Unit – 3	Number of	Title of the unit: Tests of Hypothesis and Significance
	lectures = 11	

Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value. Special tests of significance for large samples and small samples (F, chi- square, z, t- test), ANOVA.

Unit – 4	Number of	Title of the unit: Correlation and Regression
	lectures = 10	

Correlation, Rank correlation, Regression Analysis, Linear and Nonlinear Regression, Multiple regression, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Books

- i) Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Academic Foundation, ISBN: 978-8-190-93568-5.
- ii) C.R. Kothari, Research Methodology, New Age Publications, ISBN: 9386649225

- i) 1. Douglas C. Montgomery, Applied Statistics and Probability for Engineers, 5th Edition, Wiley India, ISBN: 978-8-126-53719-8.
- ii) 2. Spiegel, M. R., Schiller, J. and Srinivasan, R. A., Probability & Statistics, 3rdEdition, Tata McGraw Hill, ISBN: 978-0-070-15154-3.
- iii) R. E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye, Probability and Statistics for Engineers and Scientists,8th Edition, Pearson Education, ISBN: 978-8-131-71552-9.

	I	1				
2. Co Name	0 0	L	Т		Р	
3. Co Code		0	0		2	
4. Ty mark	pe of Course (use tick ;)	Core (✓)	PE ()		OE ()	
5. Pr	e- Engineering	6.	Even	Odd	Either	Every
requi	site Physics	Frequency	(✔)	0	Sem	Sem
(if an	y)	(use tick marks)			0	0
7. To	tal Number of Lectures, T	utorials, Practical (as	suming 14 wo	eeks of one s	emester)	
Lectu	ires = 0	Tutorials = 0	Practica	al = 28		
8. Br	ief Syllabus	J				
	course provides a basic gro	unding in the princip	1 1 /1	1 6 1 .		
					•	
	entrates on: understanding th	ne thermodynamic law	s in relation t	o familiar ex	perience; pha	se change
ideal	entrates on: understanding the gas and flow processes; usin	ne thermodynamic law g sources of data like t	s in relation t hermodynami	o familiar exitic tables and c	perience; pha charts; applica	se change tion of th
ideal basic	entrates on: understanding the gas and flow processes; using principles to the operation of	ne thermodynamic law g sources of data like t	s in relation t hermodynami	o familiar exitic tables and c	perience; pha charts; applica	se change tion of th
ideal basic 9. Le a	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives:	ne thermodynamic law g sources of data like t of various vapour and g	s in relation t hermodynami as power cycl	o familiar exitic tables and c	perience; pha charts; applica	se change tion of th
ideal basic 9. Le a i) To	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of	he thermodynamic law g sources of data like t f various vapour and g f classical thermodyna	s in relation t hermodynami as power cycl mics.	o familiar ex tables and c les; and fuels	perience; pha charts; applica and combusti	se change ation of th on.
ideal basic 9. Lea i) To ii) To	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody	the thermodynamic law g sources of data like to of various vapour and g f classical thermodyna ynamics to various system	s in relation t hermodynami as power cycl mics. ems and analy	o familiar ex ic tables and c les; and fuels yze the signif	perience; pha charts; applica and combusti	se change ation of th on.
ideal basic 9. Les i) To ii) To iii) To	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of	the thermodynamic law g sources of data like the of various vapour and g f classical thermodyna ynamics to various systent f thermodynamic gas a	s in relation t hermodynami as power cycl mics. ems and analy	o familiar ex ic tables and c les; and fuels yze the signif	perience; pha charts; applica and combusti	se change ation of th on.
ideal basic 9. Lea i) To ii) To iii) To iii) To iv) To	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody	the thermodynamic law g sources of data like the of various vapour and g f classical thermodyna ynamics to various systent f thermodynamic gas a	s in relation t hermodynami as power cycl mics. ems and analy	o familiar ex ic tables and c les; and fuels yze the signif	perience; pha charts; applica and combusti	se change ation of th on.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas magnetic b) analyze the performance of b)	the thermodynamic law g sources of data like to of various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a ixtures.	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signif	perience; pha charts; applica and combusti	se change ation of th on.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co i) Un ii) Di	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas main purse Outcomes (Cos): anderstand the working principles of inferentiate between differentiate	the thermodynamic law g sources of data like to of various vapour and g f classical thermodyna mamics to various syst f thermodynamic gas a fixtures.	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signif	perience; pha charts; applica and combusti	se change ation of th on.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co i) Un ii) Di iii) Di	entrates on: understanding the gas and flow processes; usin principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas main ourse Outcomes (Cos): inderstand the working princi- ifferentiate between differentiate for the top of the top of the top of the top of the ifferentiate combustion procession.	the thermodynamic law g sources of data like the f various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a f thermodynam	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the	se change ation of the on. results.
ideal basic 9. Les i) To ii) To iii) To iv) To iv) To iv) Un ii) Di iii) Di iii) Di iii) Di	entrates on: understanding the gas and flow processes; usine principles to the operation of arning objectives: apply the basic principles of apply the laws of thermody analyze the performance of a understand the ideal gas man burse Outcomes (Cos): anderstand the working principle inferentiate between differentiate inferentiate combustion proce- nalyze the performance of analyze the performance of the performa	the thermodynamic law g sources of data like the f various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a f thermodynam	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the	se change ation of the on. results.
ideal basic 9. Les i) To ii) To iii) To iii) To iv) To 10.Co i) Un ii) Di iii) Di iii) Di iii) Di iii) Di iii) Di	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas man ourse Outcomes (Cos): anderstand the working principle ifferentiate between differentiate ifferentiate combustion proce- nalyze the performance of ermodynamic performance.	the thermodynamic law g sources of data like the f various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a f thermodynam	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the	se change ation of the on. results.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co i) Un ii) Di iii) Di iii) Di iii) Di 10.to 11. U	entrates on: understanding the gas and flow processes; usin principles to the operation of arning objectives: apply the basic principles of apply the laws of thermody analyze the performance of aunderstand the ideal gas mite ourse Outcomes (Cos): inderstand the working princip ifferentiate between different ifferentiate combustion proce- nalyze the performance of ermodynamic performance.	the thermodynamic law g sources of data like the f various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a f thermodynam	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the methods to	se change tion of th on. results.
ideal basic 9. Les i) To ii) To iii) To iii) To iv) To 10.Co i) Un ii) Di iii) Di iii) Di iii) Di iii) Di iii) Di	entrates on: understanding the gas and flow processes; using principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas man ourse Outcomes (Cos): anderstand the working principle ifferentiate between differentiate ifferentiate combustion proce- nalyze the performance of ermodynamic performance.	the thermodynamic law g sources of data like the f various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a f thermodynam	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the	se change tion of th on. results.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co i) Un ii) Di iii) Di iii) Di iii) Di 10.to 11. U	entrates on: understanding the gas and flow processes; usin principles to the operation of arning objectives: apply the basic principles of apply the laws of thermody analyze the performance of aunderstand the ideal gas mite ourse Outcomes (Cos): inderstand the working princip ifferentiate between different ifferentiate combustion proce- nalyze the performance of ermodynamic performance.	the thermodynamic law g sources of data like the f various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a f thermodynam	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the methods to	se change tion of the on. results.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co i) Un ii) Di iii) Di iii) Di iii) Di iii) Di fii) Di sii) Di Sr. No.	entrates on: understanding the gas and flow processes; usin principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas man ourse Outcomes (Cos): inderstand the working princi- differentiate between differentiate ifferentiate combustion proce- nalyze the performance of ermodynamic performance. init wise detailed content Title	he thermodynamic law g sources of data like to of various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a ixtures. iple of Engine and Gas t types of boilers. ess. f gas and vapour p	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the methods to COs Co	se change tion of the on. results.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co i) Ur ii) Di iii) Di iii) Di iii) Di the 11. U Sr. No.	entrates on: understanding the gas and flow processes; usin principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas mit ourse Outcomes (Cos): inderstand the working princi- ifferentiate between different ifferentiate between different ifferentiate combustion proce- nalyze the performance of ermodynamic performance. init wise detailed content Title Study of Fire Tube boiler.	he thermodynamic law g sources of data like to of various vapour and g f classical thermodyna rnamics to various syst f thermodynamic gas a ixtures. aple of Engine and Gas t types of boilers. ess. f gas and vapour p	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the methods to COs Co ii)	se change tion of the on. results.
ideal basic 9. Les i) To ii) To iii) To iv) To 10.Co i) Ur ii) Di iii) Di iii) Di iii) Di iii) Di Sr. No. 1 2	entrates on: understanding the gas and flow processes; usin principles to the operation of arning objectives: b) learn the basic principles of b) apply the laws of thermody b) analyze the performance of b) understand the ideal gas man ourse Outcomes (Cos): inderstand the working princi- ifferentiate between different ifferentiate between different ifferentiate combustion proce- nalyze the performance of ermodynamic performance. init wise detailed content Title Study of Fire Tube boiler.	he thermodynamic law g sources of data like to of various vapour and g f classical thermodyna ynamics to various syst f thermodynamic gas a ixtures. The of Engine and Gas t types of boilers. ess. f gas and vapour p stroke petrol Engine.	s in relation t hermodynami as power cycl mics. ems and analy nd vapour pov	o familiar ex ic tables and c les; and fuels yze the signifi wer cycles.	perience; pha charts; applica and combusti icance of the icance of the methods to COs Co ii) ii)	se change tion of the on. results.

6	Study of steam Engine model.	i), ii), iii)
7	Study of Impulse & Reaction turbine.	i)
8	Study and working of two stroke Diesel Engine.	i), iii)
9	Study and working of four stroke Diesel Engine.	i), iii)

			nical Engineering					
	Course	Advance	L	Т		Р		
Name	e	Graphics and						
		Design Lab						
3. (Course		0	0		2		
Code								
		se (use tick mark)	Core (✓)	PE ()	EAS ()	OE ()	BSC ()	
	Pre-	Geometry and	6. Frequency	Even	Odd ()	Either	Every	
requi	isite (if any)	Drawing at +2 Level	(use tick marks)	(✔)		Sem ()	Sem ()	
		Level						
7. [Total Number	r of Lectures, Tutor	ials, Practical (assuming	14 week	s of one se	emester)		
Lectures	=0		Tutorials = 0	Practic	al = 28			
8.	Course Descr	iption						
Engineeri	ng Graphics a	and design is conside	red as language of engine	ers. This	course is	introduced	d to provid	
			ing aspects in engineering					
			concepts of introduction t					
			s the end of the course, it is					
	-		om any drawing sheet, for illustrate the concepts cle		by the pro	jection te	chiliques.	
	r enosen proor							
i) ii ii: :-) To develop i) To constru	the skills of reading	ots of drafting in Solid Wo & interpretation of components using differen	onent Dra it views.	awings.	at a cata		
iv 10 (Course Outco		ng complete engineering d	nawings		nt parts.		
i)		. ,	Work software and draftin	ng using i	t.			
ii				• •				
ii	i) Able to dra	e visualization skills	and use of projection met	nous.				
ix			and use of projection methers using the basic concepts		on of lines,	planes an	d solids.	
		aw the different views		projectio		•	d solids.	
11. L	ab Content	aw the different views	s using the basic concepts	projectio		- 		
11. L		aw the different views	s using the basic concepts	projectio		- 	d solids.	
11. L	ab Content Title	aw the different views	s using the basic concepts trial components using So	projectio		- 		
11. L Sr. No.	ab Content Title Introduction	aw the different views draw complete indus to Solid Works softw	s using the basic concepts trial components using So	projectio		- 	Covered	
11. L Sr. No. 1	ab Content Title Introduction Working on	aw the different views draw complete indus to Solid Works softw	s using the basic concepts trial components using So vare nds and user interface.	projectio		- 	Covered i)	
11. L Sr. No. 1 2	ab Content Title Introduction Working on Projection of	aw the different views draw complete indus to Solid Works softw Solid Works comma	s using the basic concepts trial components using So vare nds and user interface.	projectio		- 	Covered i) i)	
11. L Sr. No. 1 2 3	Ab ContentTitleIntroductionWorking onProjection ofProjection of	aw the different views draw complete indus to Solid Works softw Solid Works comma f lines on Solid Work f planes using Solid W	s using the basic concepts trial components using So vare nds and user interface.	projectio		- 	Coveredi)i)i)	
11. L Sr. No. 1 2 3 4	ab ContentTitleIntroductionWorking onProjection ofProjection ofProjection ofProjection of	aw the different views draw complete indust to Solid Works softw Solid Works comma f lines on Solid Work f planes using Solid W f cones and other soli	s using the basic concepts trial components using So vare nds and user interface.	projectio		- 	Covered i) i) i) i) i)	
11. L Sr. No. 1 2 3 4 5	ab ContentTitleIntroductionWorking onProjection ofProjection ofProjection ofProjection ofProjection of	aw the different views draw complete indust to Solid Works softw Solid Works command f lines on Solid Work f planes using Solid Work f cones and other soli f Prisms and other so	s using the basic concepts trial components using So vare nds and user interface. ts. Works ds on Solid Works - I	projectio	s software		Covered i) i) i) i) i) i), ii) i), iii)	

9	Design Isometric projection of simple machine elements and engineering drawings.	i), ii), iv)
10	Design Sectional views of simple machine elements and engineering drawings.	i), ii), iv)

1. Nam	e of the Dens	artment- Mechanica	l Engineering				
	rse Name	Basics of	L	Т		Р	
2. Cou		Automobile	L	1		1	
		Engineering Lab					
		Engineering Lab					
3. Cou	rse Code		0	0		2	
4. Type	e of Course (1	use tick mark)	Core (✓)	PE ()	EAS ()	OE ()	BSC ()
5. Pre- 1	requisite (if	NA	6. Frequency (use	Even	Odd ()	Either	Every
any)	-		6. Frequency (use tick marks)		Odd ()	Sem ()	Sem ()
7. Tota	l Number of	Lectures, Tutorials,	Practical (assuming 14	weeks of	one semes	ster)	L
Lectures	=0		Tutorials = 0	Practica	al = 28		
8. Cour	rse Descriptio	on					
	-						
			epth knowledge of vehicl				
			and safety engineering it			0	afacture and
operation	of motorcycle	e, automobile, buses a	and trunks and their respec	ctive engin	neering su	bsystem.	
9. Lear	ning objectiv	/es:					
	0 0		cepts of Automotive Chas	sis.			
	-	-	ile systems concerning con		ehicles		
	•		ding and improving the pe			nobile cha	ssis system
-	•	•	ding the Steering mechani				
	-	÷	on of this course, the stud	-		ing.	
			ad functions of Automobil				
		-	and functions of Autom	-		me such	as steering
		ear Box, Fuel injection			uor syste	ins such	as steering,
	-	•	•	of obaccia	from ho	dr. anaina	amina dmissa
			nnological developments	of chassis	frame, bo	dy engine	ening, unve
	nes & steering	•					
		concept of brakes, ty	res and wheels.				
	Lab Content						
Sr. No.	Title					CO	Covered
1	To study and	d prepare report on th	e constructional details, w	orking pr	inciples a	nd	i)
			otive Engine Systems & S				,
	1	linder : Diesel and Pe	6 1	-			
	(b) Engine c	ooling & lubricating	Systems.				
		tarting Systems.					
		Point & Electronic Ig					
2			e constructional details, w	orking pr	inciples a	nd	i)
		the following Fuels s	supply systems:				
	(a) Carburet						
		uel Injection Systems					
2		Fuel Injection System		ionking en	incinles a	ad	::)
3		the following Autom	e constructional details, w	orking pr	merpies at	IU	ii)
	(a) Coil-Spri		iouve Clutches.				
	-	gm – Spring Clutch.					
	(c) Diaphrag						
	(c) Double I	JISK CIUICII.					

4	 To study and prepare report on the constructional details, working principles and operation of the following Automotive Transmission systems. (a) Synchromesh – Four speed Range. (b) Transaxle with Dual Speed Range. (c) Four Wheel Drive and Transfer Case. (d) Steering Column and Floor – Shift levers. 	ii)
5	 To study and prepare report on the constructional details, working principles and operation of the following Automotive Drive Lines & Differentials. (a) Rear Wheel Drive Line. (b) Front Wheel Drive Line. (c) Differentials, Drive Axles and Four-Wheel Drive Line. 	iii)
6	To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.(a) Front Suspension System.(b) Rear Suspension System.	ii)
7	 To study and prepare report on the constructional details, working principles and operation of the following Automotive Steering Systems. (a) Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering. (b) Power steering Systems, e.g. Rack and Pinion Power Steering System. (c) Steering Wheels and Columns e.g. Tilt & Telescopic steering Wheels, Collapsible Steering Columns 	ii)
8	To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels. (a) Various Types of Bias & Radial Tyres. (b) Various Types of wheels.	iv)
9	 To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems. (a) Hydraulic & Pneumatic Brake systems. (b) Drum Brake System. (c) Disk Brake System. (d) Antilock Brake System. (e) System Packing & Other Brakes. 	iv)

2. Course Name	Object Oriented	L	Τ	Р
	Programming Lab			
3. Course Code	Lau	0	0	2
4. Type of Course (use tick mark)		Core ()	PE ()	OE ()
5. Pre-requisite (if)	6. Frequency (use	Even Odd	Either Every
any)		tick marks)		Sem() Sem
7. Total Number of L	ectures, Tutorials,	Practical (assuming 14	4 weeks of one sen	nester)
Lectures = 0		Tutorials = 0	Practical = 28	
8. Course Description	1		·	
9. Learning objectiv	es:			
• To understand	fundamentals of pro	ogramming such as varia	ables, conditional a	nd iterative
execution, mether				
	•	ject-oriented programmi	ng in Java, includi	ng defining
	ng methods, using c			
	, ,	outer program to solve s	pecified problems	
10. Course Outcomes	· /			
		pporting object-oriented		
		C++ as an object oriente	ed programming la	nguage
11. List of Experimen				
	-	rious control structures.		
a. if statement b. switc		d do while loop		
c. for loopd. while loop				
2. Programs to underst	and structure &unic	ons.		
a. structure b. union	1 • , • , 1			
3. Programs to underst	and pointer arithme	etic.		
5. Inline functions.				
6. Programs to underst		on call mechanism.		
a. call by reference b. c	-			
 Programs to underst Constructors & destr 	0 1			
9. Use of -this pointer 10. Programs to imple	-	d function overriding		
a. multiple inheritance		a function overflamg.		
-	-	riding /virtual Function		
		operators as member fur	nction & non memb	er
function.		operators as member ru	letton whom memo	
a. unary operator as me	ember function			
b. binary operator as n		n		
12. Programs to unders				
a. friend Function b. fr				
13. Programs on class	templates			
-	-	a student passed the example	m or not based on t	otal mark which
shall be above40%		-		
15. Create a C++ progr		o distances in inch-feet gram calculates the sum	•	
	/ 1 0			<u> </u>

3rd Semester

2. Course Name	Strength of Materials	L	Т	Р
3. Course Code		3	0	0
4. Type of Course (u	ise tick mark)	Core (✓)	PE ()	OE ()
5. Pre-requisite (if any)	Basic Engg. I and Mathematics	6. Frequency (use tick marks)	Even Odd () (✔)	Either Every Sem () Sem ()
7. Total Number of	Lectures, Tutorials, 1	Practical (assuming 14 we	eks of one semeste	er)
Lectures = 42		Tutorials =0	Practical = 0	
8. Course Description	n			
applied to structural mendiagram are some of the 9. Learning objectiv	e topics covered by thi	formation deflection, torsic s subject.	n, flexure, shear di	agram, and moment
member. iii) To analyze and element and fai	understand different i understand principal s lure mechanisms in m	nternal forces, stresses and stresses due to the combinat aterials. members, columns and stru	ion of two-dimens	
10. Course Outcomes	s (COs): On completio	on of this course, the studen	ts will be able:	
consideration ofii) To evaluate the shear and bendiiii) To apply the co to two-dimension	f a material. strength of materials s ng loads. ncept of Principal stre onal loading condition	help of relationship between subjected to various interna ss and strain in order to pre hing the machine elements s	l forces such as cor vent the failures in	npression, tension, materials subjected
11. Unit wise detailed	1			
Unit-1	Number of lectures = 10	Title of the unit: Stresse	s and Strains	
Elastic constants – Pois	sson's ratio – relation	stress, and normal strain an ship between elastic consta simple and compound bars	ints and Poisson's	ratio – Generalized
Unit – 2	Number of lectures = 11	Title of the unit: Simple	Bending & Deflec	ction of Beams

Types of beams: Cantilever, simply supported, Over hanging: Shear Force and Bending Moment Diagrams. Theory of simple bending – bending stress and shear stress in beams, Deflection of beams by Double integration method – Macaulay's method.

Unit – 3	Number of	Title of the unit: Bi-axial Stress system
	lectures = 11	

Biaxial state of stress – Stress at a point – stresses on inclined planes – Principal stresses and Principal strains and Mohr's circle of stress, Theories of failure

Thin cylinders and shells - deformation of thin cylinders and shells; Thick Cylinders,

Unit – 4	Number of	Title of the unit: Torsion and columns
	lectures = 10	

 $Introduction \ to \ Torsion-derivation \ of \ shear \ strain-Torsion \ formula-stresses \ and \ deformations \ in \ circular \ and \ hollow \ shafts-Stepped \ shafts-shafts \ fixed \ at \ the \ both \ ends.$

Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, struts with different end conditions, Euler's theory for pin ended columns.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Khurmi, R.S., (2019) "A Text Book of Strength of Materials", S. Chand Publishing India, ISBN: 9789352833979, 935283397X

- i) B.S. Basavarajaiah, P.Mahadevappa (2010) "Strength of Materials" CRC Press Publication India, 3rd Edition, ISBN-13 : 978-1439854198.
- ii) Rattan S.S. (2011) "Strength of Materials" McGraw-Hill Education (India) Pvt Limited, ISBN: 9780071072564, 007107256X.
- iii) Bansal R.K. (2010) "A Text book of Strength of Materials" 5th Edition (In Si Units), Laxmi Publication, India, ISBN: 9788131808146, 8131808149.
- iv) DeWolf, John T.. "Mechanics of Materials" (In Si Units), Tata McGraw-Hill, Third Edition, ISBN: 9780070535107, 0070535108.

	-	tment- Mechanical I					
2.	Course Name	Engineering Mechanics	L		Γ]	P
3.	Course Code		3		0		0
4.	Type of Course (us	e tick mark)	Core (✓)	PE ()		OE ()	
5.	Pre-requisite (if any)	Engg. Physics & Mathematics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.		ectures, Tutorials, P	ractical (assuming 14 w			er)	
Le	ectures = 42		Tutorials = 0	Practica	$\mathbf{al} = 0$		
8.	Course Description	1					
	ii) To calculate the	tudents with the basic reactive forces and an	•		life situa	tions.	
10	 i) To familiarize still ii) To calculate the iii) To familiarize still iv) To know the condition course Outcomes (i) Solve the engine various supports 	tudents with the basic reactive forces and an tudents with the conce ncepts of kinematics a (COs): After successf eering problems in ca s of different structure	nalyze the structures. ept of friction and virtual and to learn energy and m ful completion of this cour- ase of equilibrium condit es.	work. omentum m rse students ions and ca	nethods. will be a lculate th	uble to ne reaction	
10	 i) To familiarize si ii) To calculate the iii) To familiarize si iv) To know the condition course Outcomes (in the integration of the engine various supports in the site of the problem and momentum in the condition of the problem and momentum is a specific of the problem and momentum in the condition of the problem and momentum is a specific of the problem and momentum in the problem and momentum is a specific of the problem and momentum in the problem and momentum is a specific of the problem and momentum in the problem and momentum is a specific of the problem and momentum and moment	tudents with the basic reactive forces and an tudents with the conce ncepts of kinematics a (COs): After successf eering problems in ca s of different structure ems involving dry fric to solve real life prob entroid, center of grav	nalyze the structures. ept of friction and virtual and to learn energy and m ful completion of this cour- ase of equilibrium condit es. ction and virtual work. A lems vity and moment of inertia	work. omentum m rse students ions and ca pply concep a of various	nethods. will be a lculate th ots of con surfaces	able to ne reaction nservation of and solids.	of energ
	 i) To familiarize si ii) To calculate the iii) To familiarize si iv) To know the condition course Outcomes (in the integration of the engine various supports in the site of the problem and momentum in the condition of the problem and momentum is a specific of the problem and momentum in the condition of the problem and momentum is a specific of the problem and momentum in the problem and momentum is a specific of the problem and momentum in the problem and momentum is a specific of the problem and momentum in the problem and momentum is a specific of the problem and momentum and moment	tudents with the basic reactive forces and an tudents with the conce accepts of kinematics a (COs): After successf eering problems in ca s of different structure ems involving dry fric to solve real life prob entroid, center of grav	nalyze the structures. ept of friction and virtual and to learn energy and m ful completion of this cour- ase of equilibrium condit es. ction and virtual work. A lems	work. omentum m rse students ions and ca pply concep a of various	nethods. will be a lculate th ots of con surfaces	able to ne reaction nservation of and solids.	of energ
11	 i) To familiarize stiii) To calculate the iii) To familiarize stiii) To familiarize stiii) To know the control of the contr	tudents with the basic reactive forces and an tudents with the conce accepts of kinematics a (COs): After successf eering problems in ca s of different structure ems involving dry fric to solve real life prob entroid, center of grav	nalyze the structures. ept of friction and virtual and to learn energy and m ful completion of this cour- ase of equilibrium condit es. ction and virtual work. A lems vity and moment of inertia	work. omentum m rse students ions and ca pply concept a of various using principal librium of b	nethods. will be a lculate th ots of con surfaces iple of ki	able to ne reaction nservation of and solids. nematics.	of energ
11 Ur Int boo two	 i) To familiarize stii) To calculate the ii) To familiarize stii) To familiarize stii) To know the condition of the conditic	tudents with the basic reactive forces and an tudents with the conce ncepts of kinematics a (COs): After successf eering problems in ca s of different structure ems involving dry frid to solve real life problemtroid, center of grav tcome of applied forc content Number of lectures = 12 cs – Fundamental Pri- tium of particle in spa- is of plane trusses –M	halyze the structures. ept of friction and virtual and to learn energy and m ful completion of this cour- ase of equilibrium condit is. etion and virtual work. A lems vity and moment of inertia es acting on a rigid body Title of the unit: Equi Trusses & Virtual wor nciples – Coplanar forces ce – Single equivalent for lethod of joints – Method	work. omentum m rse students ions and ca pply concep a of various using prince librium of l rk s – Equilibri rce, Equilibri	ethods. will be a lculate th ots of con surfaces iple of ki Particle fum of pa rium of r	able to ne reaction nservation of and solids. nematics. and Rigid articles – Fr	body, ree in

Characteristics of dry friction – Problems involving dry friction – Ladder – Wedges. – System of connected rigid bodies – Conservative forces – Potential energy – Potential energy criteria for equilibrium. Centroid – First moment of area – Theorems of Pappus and Guldinus – Second moment of

& moment of inertia

lectures = 10

area - Moment and Product of inertia of plane areas - Transfer Theorems - Polar mod	ment of inertia –
Principal axes – Mass moment of inertia.	

Unit – 3	Number of	Title of the unit: Kinematic and Kinetics
	lectures = 10	

Position, Velocity and Acceleration – Rectilinear motion – Curvilinear motion of a particle – Tangential and Normal components –Radial and Transverse components – Rotation of rigid bodies about a fixed axis – General plane motion – Absolute and relative motion method – Instantaneous centre of rotation in plane motion.

Linear momentum – Equation of motion – Angular momentum of a particle and rigid body in plane motion – D'Alembert's principle.

Unit – 4	Number of	Title of the unit: Energy and Momentum Methods
	lectures = 10	

Principle of work and energy for a particle and a rigid body in plane motion – Conservation of energy Principle of impulse and momentum for a particle and a rigid body in plane motion – Conservation of momentum – System of rigid bodies– Impact -direct and central impact – coefficient of restitution. Introduction of Advanced and recent methods of analyzing a structure for equilibrium

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books R	Recommended
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Text Book:

i) Engineering Mechanics by R S Khurmi, S Chand & Co Ltd, Revised Edition, ISBN: 9788121926164 Reference Books:

- i) J. V. Rao, D. H. Young, S. Timoshenko, Sukumar Pati (2013), Engineering Mechanics, Tata McGraw Hill Education. ISBN: 978-1-259-06266-7
- ii) Irving H. Shames (2012), Engineering Mechanics Statics and Dynamics, 4th Edition, Prentice-Hall of India Private limited. ISBN: 978-8-131-72883-3

iii) P. Ferdinand, E. Beer and J. Russell (2010), Vector Mechanics for Engineers, 9th Edition, McGraw-Hill International Edition. ISBN: 978-0-079-12637-5

Department Electives-I

1. Name of the	e Department- Mecha	nical Engineering				
2. Course	Refrigeration and	L	Т		Р	
Name	Air Conditioning					
3. Course		3	0		0	
Code						
4. Type of Co	urse (use tick mark)	Core ()	PE (✓)	OE ()	
5. Pre-	Engineering	6. Frequency	Even ()	Odd (✔)	Either Sem	Every Sem
requisite	Thermodynamics	(use tick			0	0
(if any)		marks)				
	per of Lectures, Tutor				emester)	
Lectures =	42	Tutorials = 00	Practi	cal = 00		
8. Course Desc	-					
U U	l air conditioning are u	•	•	-	÷	
	em(R) transfers heat fr	om a cooler low-ene	rgy reservoir	to a warme	r high-energy	reservoir.
9. Learning of	0					
	stand the principles of	-	-			
	late the cooling load for		ns of Refrige	eration and A	Air conditionir	ıg.
,	the principles of psych	•				
	op the knowledge of se	electing the right equ	ipment for a	particular a	pplication of I	Refrigeration
	conditioning.					
10. Course Out						
	he knowledge of syste	-	-			
ii) Design and implement refrigeration and air conditioning systems using standards.						
iii) Apply th	e knowledge of psychr	ometry in calculating	g cooling loa	d and heatin	g load calcula	tions.
iv) Possess t	he knowledge of syste	m components of ref	rigeration an	d air conditi	oning.	
11. Unit wise d	etailed content					
Unit-1	Number of lectures	Title of the unit: F	Refrigeration	o Cycles		
	= 12					
	ession refrigeration c	• •	-	-	-	-
	cle-P-H charts - Mult	i stage compression	-Multi evap	orator syste	m-cascade sy	stem-Vapour
absorption syste						
Unit – 2	Number of lectures = 09	Title of the unit: S	ystem Com	ponents		
ũ.	assification –Designati	•		•	-	U
Refrigerant cor	npressors Reciprocatin	ng –Rotary - Conder	nsers - Evapo	orators - Ex	pansion devic	es - Cooling
towers.	towers.					
Unit – 3	Unit - 3Number of lecturesTitle of the unit: Psychrometry System= 9					
Moist air prope	rties - Psychrometric c	hart - Different Psyc	hrometric pro	ocess analys	is.	
	Number of lectures	Title of the unit: A	ir Condition	ning		
Unit – 4	= 12					
		tion - Cooling load	calculations	- different	types of loads	- GRSHF -
Air conditionin	= 12	-				
Air conditionin ERSHF - Estim	= 12 g systems – classifica	r distribution patterns				

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Arora, C. P., (2008), Refrigeration and Air Conditioning, Tata McGraw-Hill Publishing Company Ltd. ISBN: 978-0-070-08390-5.

- i) Manohar Prasad, (2003), Refrigeration and Air conditioning, New Age International, ISBN: 978-8122414295.
- W. F. Stocker and J. W. Jones, Refrigeration and Air conditioning, McGraw Hill, (2014), 2nd Edition ISBN: 9789332902954
- iii) R. S. Khurmi, A Text Book for Refrigeration and Air conditioning, (2020)Edition, ISBN: 978-81-219-2781-9

2.	Course	Department- Mecha Advanced	L		Т		Р
4.			L		1		r
	Name	Machining Processes					
3	Course	TTOCCSSCS	3		0		0
5.	Code		5		U		U
4.		se (use tick mark)	Core ()	PE (✓)	OE ()	
	Pre-	se (use tiek mark)	6. Frequency	Even ()) Odd (✔)	Either Sem	Every Sem
5.	requisite (if		(use tick		Ouu (*)	()	
	any)		(use tick marks)			V	V
7	-	r of Lectures Tuto	rials, Practical (assu	ming 14 wee	ks of one se	mester)	
/•	Lectures $= 4$		$\frac{11}{11} = 0$	_	$\frac{1}{cal} = 0$	(incstel)	
8.			1 utor rais = 0	Tacu	cai – 0		
		-	and difficult-to-mach	nine material	s such as to	ugh super allo	vs ceramics
			machining processes				
	-		to advance machini	-			
	-		es of energy to machin				
		-	achining processes a			-	•
	0 0		course for anyone des	•	•		
	chining process	•	eouise for any one ae	51511115, 10500			liore uu vulle
	Learning obj						
- •	0 0		hanical Advanced Ma	achining Prod	cesses		
		tand the concept of E			000000		
		•	BM, EBM, PAM etc.				
		-	dvance finishing prod				
10	. Course Outco						
	i) Acquire K	nowledge of manufa	cturing process for a	dvanced mate	erials and cr	itical finishing	
	· -	nowledge of concep	• •			c	,
	· •	0 1	t of IBM, EBM, PAM	I etc.			
	· •	U 1	t of advance finishing				
		of the second seco	2	, i i i i i i i i i i i i i i i i i i i			
11	. Unit wise det	ailed content					
	. Ont wise ded	Number of	Title of the unit: M	loobonical A	dyanood M	ochining Pro	205505
Ľ) 1111-1	lectures = 11	The of the unit. M	lechanical A		acining 110	163363
N	leed and class		litional machining p	mocesses -	Material re	moval in tra	ditional and
			- considerations in p				
		• •	val – Theory of Shav				-
_	-		d numerical. Abrasiv		-		
	-		s, equipment's proce	•		-	
	pplication and l			,			,
_	Jnit - 2	Number of	Title of the unit: E	lectric Disch	arge Mach	ining	
-		lectures =10			0	0	
v	Vorking princip	le of EDM, Power of	circuits for EDM - R	C pulse gen	erator and c	ontrolled puls	e generator-
v							
	analysis of R-C	Circuits – Mechanics	of metal removal in I	EDM, Process	s parameters	s, selection of t	ool electrod

development in EDM. Wire EDM – Working principle, process variables, process characteristics and applications. Electric discharge grinding and electric discharge diamond grinding - working principle, process capabilities and applications.

Unit – 3	Number of	Title of the unit: Laser, Electron Beam, Ion Beam and Plasma Arc
	lectures = 11	Machining

General working principle of laser beam machining – Generation of Laser, types of Lasers, process characteristics and applications. Electron Beam Machining - Equipment for production of Electron Beam, theory of EBM, thermal and non-thermal type, process characteristics and applications. Ion Beam Machining - Mechanism of metal removal and associated equipments, process characteristics and applications. Plasma Arc Machining - Metal removal mechanism, process parameters, process characteristics, types of torches, applications.

Unit – 4	Number of	Title of the unit: Advanced Finishing Processes
	lectures = 10	

Abrasive flow Machining (AFM) - working principle, AFM system, process variables, process performance and applications. Magnetic abrasive finishing (MAF) - working principle, MAF system, material removal and surface finish, process variables and applications. Chemo mechanical polishing, working principle, material removal and surface finish and applications

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

 V. K. Jain (2004), Advanced Machining Processes, 1st Edition, Affiliated Allied Publishers. ISBN: 978-8-177-64294-0.

- i) Hassan El-Hofy (2005), Advanced Machining Processes, 1st edition Affiliated McGraw-Hill. ISBN: 978-0-071-45334-9.
- Gary F. Benedict (1987), Nontraditional Machining Processes, 1st Edition, Affiliated CRC press. ISBN 082-4-773-527.
- iii) M. Adithan (2008), Modern Machining Methods, 1st Edition, Affiliated Khanna Publishers New Delhi. ISBN: 978-8-174-09225-0.

1. Name of t	he Department- Mech	anical Engineering				
2. Course	Advance	L		Т]	Р
Name	Automobile					
	Engineering					
3. Course		3		0		0
Code						
4. Type of C	ourse (use tick	Core ()	PE (✔))	OE ()	
mark)						
5. Pre-	Basics of	6. Frequency	Even	Odd (✔)	Either	Every
requisite	Automobile	(use tick	0		Sem	Sem
(if any)	Engineering	marks)			0	0
7. Total Nu	nber of Lectures, Tuto	orials, Practical (assu	ning 14 wee	ks of one ser	nester)	
Lectures	= 42	Tutorials = 0	Practic	al = 0		
8. Course D	escription					
	gineering is the one of t	he streams of mechania	cal engineeri	ng It deale w	vith the various	types of
			-	-		
	eir mechanism of trans d for transportation of p	•	••			• •
	ernal combustion proces		-	• •		
• •	of fuels are burnt inside		•			•
• •		•		0	Institussion mo	tion in the
	of the automobiles are i	internal combustion en	gines venicie	es onry.		
9. Learning						
	aden the understanding		ture of vehic	ele chassis and	d engines.	
ii) To intr	oduce students to Trans	mission system.				
iii) To intr	oduce students to steeri	ng, suspension, braking	g and transm	ission system	18.	
iv) To intr	oduce students to engin	e auxiliary systems like	e heating, ve	ntilation and	air-conditionir	ng and als
the imp	portance of alternate fue	els.				
10. Course O	utcomes (COs):					
i) Develo	p chassis and identify s	uitable engine for diffe	rent applicat	tions.		
ii) Able to	select a suitable conve	ntional and automatic	ransmission	system for th	ne Vehicle.	
iii) Formu	ate steering, braking an	d suspension systems.		2		
	y the usage of Electrical	1 2	icles and pov	ver plants		
,	detailed content	i venieles / Hyona ven	letes and por	ver pluites.		
Unit-1	Number of	Title of the unit: Int	roduction t	o Vobiolo Sti	noturo	
Unit-1	lectures = 08			o venicie su	ucture	
Vahiala agent		dy Specifications E	naina Truna	Constant	on Location	of ongine
	uction, Chassis and be gement, Construction de	• •	• • •			•
•		•	_ymuer nea	u, Cymider m	ners, Fiston, p	iston migs
· ·	necting rod, Crankshaf		m Tunco V	Votor numera	Dadiators Th	armastat
Anti-freezing c	stem, Types, Oil pumps	s, riners, cooning syste	m, Types, V	water pumps,	, Kaulators, Ir	iennostats
	-		··· E L	<u>a 1 11</u>		4 1
Unit – 2	Number of lectures = 10	Title of the unit: Ig System	ntion, Fuel	Supply and	Emission Con	trol
Coil and Magn	eto - Spark plug - Distril		ion system -	Fuel system -	Carburetor - F	Fuel pump
e e	systems– Module inje	e e	•	•		
•	n - Passenger comfort	• •		•	-	
	Electronic Control Mod	• •			-	
	n(MPFI) - Gasoline Dir					_
injection system			unuole val	••••••••••••••••••••••••••••••••••••••		6 G

System (ASS) - Anti-lock Braking System (ABS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - X-by-wire - Electric -Hybrid vehicle. Automobile Emissions - Source of formation – Effects on human health and environment -Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter -

Unit – 3	Number of	Title of the unit: Transmission System
	lectures = 10	

Clutches - Function - Types - Single plate, Multiple plate and Diaphragm Clutch - Fluid coupling - Gearbox -Manual - Sliding - Constant - Synchromesh - Overdrive - Automatic transmission - Torque converter -Continuously variable transmission - Universal joint - Propeller shaft - Hotchkiss drive – Final drive - Rear axle assembly - Types -Differential - Need - Construction — Differential locks - Four wheel drive.

Unit – 4	Number of	Title of the unit: Steering, Suspension and Braking System
	lectures = 08	

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers-Wheels and Tires - Construction - Type and specification - Tire wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Kirpal Singh (2011), Automobile Engineering, 12th edition, Standard Publications, ISBN: 9788180141775

- i) William H. Crouse (2006), Automotive Mechanics, 10th Edition, McGraw Hill/ ISBN: 9780070634350
- ii) Joseph Heitner (1999), Automotive Mechanics: Principles and Practices, 2nd edition, Affiliated East West Pvt. Ltd, D. Van Nostrand Company publisher, ISBN:978-0442033026.
- iii) Bosch Automotive Hand Book (2007), 9thedition, Robert Bosch GmbH; Publications, ISBN: 978-0837617329
- iv) K. Newton and W. Steeds (2001), The motor vehicle, 13th Edition, Iliffe Books Ltd publisher, ISBN 13: 9780408011181.

Engineering 3 0 0 4. Type of Course (use tick mark) Core () PE (✓) OE () 5. Pre-requisite (if Manufacturing systems and Statistics Frequency (use tick marks) Even () Odd Either Even () Sem ()	2.	Course Name	Industrial	Engineering L	r	г	1	D
3. Course Code 3 0 0 4. Type of Course (use tick mark) Core () PE (*) OE () 5. Pre-requisite (if Manufacturing statistics 6. Frequency (use tick marks) Even () Odd Either Even (*) Sem () 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Lectures = 42 Tutorials = 0 Practical = 0 8. Course Description This course introduces the concepts of manufacturing economics and its critical parameters. Introduci thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EOQ, Invente management, Quality management, Production planning and control and Management Information systems. 9. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing. 10 10 9. Learning and measure various productivities in industrial manufacturing. 10 10 10 10 10. Course Outcomes (COs): On successful completion of this course, the student will be able to: i) Define and measure various productivities in industrial manufacturing. 10 10 Editer 10 10. Unit wise detailed content Title of the unit: Introduction 10 10 Editer 10 10. Entime and measure sof Industrial and Quality Management. 10 10 <th>2.</th> <th>Course Name</th> <th></th> <th>L</th> <th>-</th> <th>L</th> <th></th> <th>r</th>	2.	Course Name		L	-	L		r
4. Type of Course (use tick mark) Core () PE (✓) OE () 5. Pre-requisite (if any) Manufacturing systems and statistics Even () Odd Either Even () Odd Either Sem () S	<u> </u>		Engineering	2		<u> </u>		0
5. Pre-requisite (if any) Manufacturing systems and Statistics 6. Frequency (use tick marks) Even () Odd Either Even Sem () 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Even () (V) Sem () Sem () 8. Course Description Tutorials = 0 Practical = 0 Reader 8. Course introduces the concepts of manufacturing conomics and its critical parameters. Introduct thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EOQ, Inventor management, Quality management, Production planning and control and Management Information systems. 9. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing, ii) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. ii) Unterstrand the concept of Inventory control and its application. iii) Unterstrand the concept of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of Industrial and Quality Management. 12. Various methods of neasurement, Factors effecting productivity, Strategies for improving productivity, Various methods of bob evaluation & me rating, Various charts, THERBLIGS, Work measurement - various methods of Job evaluation & me rating, Various incentive payment schemes, Behavioral aspects, Financial in)		U
any) systems and Statistics tick marks) (✓) Scm ()		• •		, , , , , , , , , , , , , , , , , , ,	. ,			Г <u> </u>
Statistics 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Lectures = 42 Tutorials = 0 8. Course Description This course introduces the concepts of manufacturing economics and its critical parameters. Introduct thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EOQ, Inventor management, Quality management, Production planning and control and Management Information systems. 9. Learning objectives: i) Leam basic concept of productivities in industrial manufacturing. (ii) Leam basic concept of Inventory control and its application. iv) Leam basic concept of Inventory control and its application. (iv) Leam basic concept of Inventory control and its application. iv) Leam basic concept of Inventory control and its application. (iv) Explain key features of Industrial and Quality Management. 10. Course Outcomes (COS): On successful completion of this course, the student will be able to: (i) Perform full cost analysis for a manufacturing system. iii) Understand the concept of Inventory control and its application. (iv) Explain key features of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of Lectures = 10 11. Unit wise detailed content Unit-1 Number of Lectures = 10 11. Unit wise detailed content Productivity & Workforce Management: Productivity - Definition, Various methods of measureme			0		Even ()			Every
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Lectures = 42 Tutorials = 0 Practical = 0 8. Course Description This course introduces the concepts of manufacturing economics and its critical parameters. Introduce thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EQQ, Invente management, Quality management, Production planning and control and Management Information systems. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing, system. ii) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Define and measure various productivities in industrial manufacturing. ii) Define and measure various productivity is application. iv) Define and measure various productivity is in industrial manufacturing. iii) Define and measure various productivity for a manufacturing system. iii) Understand the concept of Inventory control and its application. iv) Explan key features of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of Lectures = 10 Title of the unit: Introduction lectures = 10		any)	•	tick marks)		(✔)	Sem ()	Sem (
Lectures = 42 Tutorials = 0 Practical = 0 8. Course Description This course introduces the concepts of manufacturing economics and its critical parameters. Introduce thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EOQ, Invente management, Quality management, Production planning and control and Management Information systems. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing. ii) Learn basic concept of Inventory control and its application. iv) iv) Learn basic concept of Industrial and Quality Management. 10. Course Outcomes (COs): On successful completion of this course, the student will be able to: i) i) Define and measure various productivities in industrial manufacturing. ii) Define and measure various productivities in industrial manufacturing. ii) Define and measure various productivities in industrial manufacturing. iii) Define and measure various productivities in industrial manufacturing. iii) Define and measure various productivity and publication. iv) Explain key features of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of lactures = 10 Title of the unit: Introduction lectures = 10 Definition of Industrial Engineering: Objectives, Method								
8. Course Description This course introduces the concepts of manufacturing economics and its critical parameters. Introduci thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EOQ, Invented management, Quality management, Production planning and control and Management Information systems. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing. ii) Learn basic concept of Industrial and Quality Management. iii) Learn basic concept of Industrial and Quality Management. 10. Course Outcomes (COs): On successful completion of this course, the student will be able to: i) Define and measure various productivities in industrial manufacturing. ii) Define and measure various productivities in industrial manufacturing. iii) Understand the concept of Inventory control and its application. iv) Explain key features of Industrial and Quality Management. iii) Understand the concept of Industrial and Quality Management. 11. Unit wise detailed content Title of the unit: Introduction lectures = 10 Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques method study - Various charts, THERBLIGS, Work measurement - various methods of De evaluation & maring, Various incentive symmet schemes, Behavioral aspects, Financial incentives. Unit - 2 Number of lectures = 12 Productivity, Various incentive schemes, Behavioral aspects, Financial incentives. Unit - 2 Number of lectures = 12 <			ectures, Tutorials, P	, U)	
This course introduces the concepts of manufacturing economics and its critical parameters. Introduci thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EOQ, Inventor management, Quality management, Production planning and control and Management Information systems. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing. ii) Learn basic concept of productivities in industrial manufacturing. iii) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Define and measure various productivities in industrial manufacturing. iii) Define and measure various productivities in industrial manufacturing. iii) Understand the concept of Inventory control and its application. iv) Explain key features of Industrial and Quality Management. 11. Unit wise detailed content Title of the unit: Introduction lectures = 10 Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques method study - Various charts, THERBLIGS, Work measurement - various methods of Job evaluation & metraing, Various incentive payment schemes, Behavioral aspects, Financial incentives. Unit - 2 Number of lectures = 12 Title of the unit: Manufacturing Cost Analysis and Productivity, Various methods of Job evaluation & metraing, Various incentive schemes, Behavioral aspects, Financial incentives. Manufacturing Cost Analysis: Fixed & variable cost, Direct				Tutorials = 0	Practica	$\mathbf{l} = 0$		
thoroughly the concepts of Productivity, Fixed and Variable costs, Materials management, EOQ, Invente management, Quality management, Production planning and control and Management Information systems. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing. ii) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Inventory control and its application. iv) Explain key features of Inventory control and its application. iv) Explain key features of Inventory control and its application. iv) Explain key features of Inventory control and its application. iv) Explain key features of Inventory control and its application. iv) Explain key features of Inventory control and its application. iv) Explain key features of Inventory control and its application. iv) Explain key features of Inventory control and its application. iv) Explain key features of Inventory control and the unit: Introduction lectures = 10 Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques method study - Various charts, THERBLIGS, Work measurement - various methods, time study PMT determining time, Work force Management: Productivity - Definition, Various methods of Job evaluation & me rating, Various incentive payment schemes, Behavioral aspects, Financial incentives. Unit - 2 Number of lectures = 12 Manufacturing Cost Analysis: Fixed & variable costs, Direct, Indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labor, material, overhead volume, rate & efficiency, Break even Analysis, Marginal costing & contr								
management, Quality management, Production planning and control and Management Information systems. 9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing. ii) Learn basic concept of Inventory control and its application. iv) Learn basic concept of Industrial and Quality Management. 10. Course Outcomes (COs): On successful completion of this course, the student will be able to: i) Define and measure various productivities in industrial manufacturing. ii) Perform full cost analysis for a manufacturing system. iii) Understand the concept of Inventory control and its application. iv) Explain key features of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of lectures = 10 Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques method study - Various charts, THERBLIGS, Work measurement - various methods, time study PMT determining time, Work sampling, Numerical. Productivity & Workforce Management: Productivity - Definition, Various methods of Job evaluation & me rating, Various incentive payment schemes, Behavioral aspects, Financial incentives. Unit - 2 Number of lectures = 12 Title of the unit: Manufacturing Cost Analysis and Productivity, Strategies for improving productivity, Various methods of Job evaluation & me rating, Various incentive payment schemes, Behavioral aspects, Financial incentives. Unit - 2 <td< td=""><td></td><td></td><td>•</td><td>•</td><td></td><td></td><td></td><td></td></td<>			•	•				
9. Learning objectives: i) Learn basic concept of productivities in industrial manufacturing. ii) Learn basic concept of productivities in industrial manufacturing system. iii) Learn basic concept of Industrial and Quality Management. 10. Course Outcomes (COs): On successful completion of this course, the student will be able to: i) Define and measure various productivities in industrial manufacturing. iii) Understand the concept of Inventory control and its application. iv) Explain key features of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of lectures = 10 Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques method study - Various charts, THERBLIGS, Work measurement - various methods, time study PMT determining time, Work sampling, Numerical. Productivity & Workforce Management: Productivity - Definition, Various methods of Job evaluation & me rating, Various incentive payment schemes, Behavioral aspects, Financial incentives. Unit - 2 Number of lectures = 12 Title of the unit: Manufacturing Cost Analysis and Productivity, Stategies for improving productivity, Various methods of Job evaluation & me rating, Various incentive payment schemes, Behavioral aspects, Financial incentives. Unit - 2 Number of lectures = 12 Title of the unit: Manufacturing Cost Analysis and Productivity, Cost control, Cost variance Analysis - Labor, material, overhead volume, rate & efficiency, Break even Analysi						-		
 i) Learn basic concept of productivities in industrial manufacturing. ii) Learn basic concept of cost analysis for a manufacturing system. iii) Learn basic concept of Industrial and Quality Management. 10. Course Outcomes (COs): On successful completion of this course, the student will be able to: i) Define and measure various productivities in industrial manufacturing. ii) Perform full cost analysis for a manufacturing system. iii) Understand the concept of Inventory control and its application. iv) Explain key features of Industrial and Quality Management. 11. Unit wise detailed content Unit-1 Number of lectures = 10 Title of the unit: Introduction lecturing time, Work sampling, Numerical. Productivity & Workforce Management: Productivity - Definition, Various methods of measurement, Factors effecting productivity, Strategies for improving productivity. Various methods of Job evaluation & measure, Various intendives. Unit - 2 Number of lectures = 12 Title of the unit: Manufacturing Cost Analysis and lectures = 12 Productiving Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labor, material, overhead volume, rate & efficiency, Break even Analysis, Marginal costing & contribution, Numerical. Materi Management. Strategic importance of materials in manufacturing industries, Relevant costs. Introduction to Trotecost of Job evaluation to JT. Numerical. Unit - 3 Number of Title of the unit: Inventory Control	mar	nagement, Quality ma	anagement, Production	n planning and control and	Managem	ent Inform	nation sys	tems.
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Aggregate planning - Basic Concept, its relations with other decision areas, Decision options - Basic & mix strategies, Master production schedule (MPS), Scheduling Operations Various methods for line & intermitte production systems, Gantt chart, Introduction to JIT, Numerical.Unit - 3Number ofTitle of the unit: Inventory Control	11. Uni Def met dete Proo Fac ratin Uni Man Rec volu	iii) Understand the of iv) Explain key feat Unit wise detailed of t-1 inition of Industrial hod study - Various ermining time, Work ductivity & Workford tors effecting product ng, Various incentive t - 2 nufacturing Cost Ana- sovery of overheads, ume, rate & efficient	concept of Inventory of ures of Industrial and content Number of lectures = 10 Engineering: Objective s charts, THERBLIG sampling, Numerical. ce Management: Prod tivity, Strategies for im payment schemes, Be Number of lectures = 12 ilysis: Fixed & variable Standard costing, Co- ncy, Break even Ana	Title of the unit: Introduces, Method study, Principus, Work measurement - uctivity - Definition, Vario nproving productivity, Vario Title of the unit: Manuf Production Planning le costs, Direct, indirect & st control, Cost variance A alysis, Marginal costing of	le of mot various r us method l incentive acturing overhead of nalysis - & contrib	nethods, t ls of meas ods of Job es. Cost Ana costs, & Jo Labor, ma ution, Nu	urement, evaluation lysis and ob costing uterial, over	y PMTS n & mer
strategies, Master production schedule (MPS), Scheduling Operations Various methods for line & intermittedproduction systems, Gantt chart, Introduction to JIT, Numerical.Unit - 3Number ofTitle of the unit: Inventory Control	11. Uni Def met dete Proo Fac ratin Uni Man Rec volu	iii) Understand the o iv) Explain key feat Unit wise detailed of t-1 inition of Industrial hod study - Various ermining time, Work ductivity & Workford tors effecting product ng, Various incentive t - 2 nufacturing Cost Ana- overy of overheads, ime, rate & efficien nagement: Strategic i	concept of Inventory of ures of Industrial and content Number of lectures = 10 Engineering: Objective s charts, THERBLIG sampling, Numerical. ce Management: Prod tivity, Strategies for in payment schemes, Bo Number of lectures = 12 llysis: Fixed & variable Standard costing, Concy, Break even Ana mportance of material	Title of the unit: Introduces, Method study, Principus, Work measurement - uctivity - Definition, Vario proving productivity, Vario proving productivity, Vario production Planning le costs, Direct, indirect & st control, Cost variance A alysis, Marginal costing of ls in manufacturing industr	le of mot various r us method ious metho lincentive acturing overhead analysis - & contrib ies, Relev	nethods, t ls of meas ods of Job es. Cost Ana costs, & Jo Labor, ma ution, Nu ant costs.	urement, evaluation lysis and ob costing uterial, over merical.	y PMTS n & mer , erhead i Material
production systems, Gantt chart, Introduction to JIT, Numerical.Unit - 3Number ofTitle of the unit: Inventory Control	11. Uni Def met dete Proo Fac ratin Uni Mar Rec volu Mar Intr	iii) Understand the of iv) Explain key feat Unit wise detailed of t-1 inition of Industrial hod study - Various ermining time, Work ductivity & Workford tors effecting product ng, Various incentive t - 2 nufacturing Cost Ana rovery of overheads, ime, rate & efficien nagement: Strategic i oduction to Forecast	concept of Inventory c ures of Industrial and content Number of lectures = 10 Engineering: Objective s charts, THERBLIG sampling, Numerical. ce Management: Prod tivity, Strategies for in payment schemes, Be Number of lectures = 12 lysis: Fixed & variabl Standard costing, Co- ncy, Break even Ana mportance of material ing - Simple & Weig	Title of the unit: Introduces, Method study, Principus, Work measurement - uctivity - Definition, Vario proving productivity, Vario proving productivity, Vario production Planning le costs, Direct, indirect & st control, Cost variance A alysis, Marginal costing of ls in manufacturing industre	le of mot various r us method ious metho l incentive acturing overhead analysis - & contrib ies, Relev hods, Obj	nethods, t ls of meas ods of Job es. Cost Ana costs, & Jo Labor, ma ution, Nu ant costs. ectives &	ime study urement, evaluation lysis and ob costing uterial, ove merical.	y PMTS n & mer g erhead i Material
Unit - 3 Number of Title of the unit: Inventory Control	11. Uni Def met dete Proo Fac ratin Uni Man Rec volu Man Intrr Agg	iii) Understand the of iv) Explain key feat Unit wise detailed of t-1 inition of Industrial hod study - Various ermining time, Work ductivity & Workford tors effecting product ng, Various incentive t - 2 nufacturing Cost Ana overy of overheads, ime, rate & efficien nagement: Strategic i oduction to Forecast gregate planning - Ba	concept of Inventory of ures of Industrial and content Number of lectures = 10 Engineering: Objective s charts, THERBLIG sampling, Numerical. ce Management: Prod tivity, Strategies for in payment schemes, Be Number of lectures = 12 Ilysis: Fixed & variable Standard costing, Concy, Break even Ana mportance of material ing - Simple & Weig usic Concept, its relation	Title of the unit: Introduces, Method study, Princip S, Work measurement - uctivity - Definition, Vario nproving productivity, Vario ehavioral aspects, Financia Title of the unit: Manuf Production Planning le costs, Direct, indirect & st control, Cost variance A alysis, Marginal costing of ls in manufacturing industry ghted moving average met	le of mot various r us method ious method ious method incentive acturing overhead analysis - & contrib ies, Relev hods, Obj eas, Decis	nethods, t ls of meas ods of Job es. Cost Ana costs, & Jo Labor, ma ution, Nu ant costs. ectives & ion optior	urement, evaluation lysis and ob costing uterial, over merical.	y PMTS n & mer s, erhead i Material & of PPC & mixe
	11. Uni Def met dete Proo Fac ratin Uni Mar Rec volu Mar Intr Agg stra	iii) Understand the d iv) Explain key feat Unit wise detailed of t-1 inition of Industrial hod study - Various ermining time, Work ductivity & Workford tors effecting product ng, Various incentive t - 2 nufacturing Cost Ana eovery of overheads, ime, rate & efficien nagement: Strategic i oduction to Forecast gregate planning - Ba tegies, Master product	concept of Inventory of ures of Industrial and content Number of lectures = 10 Engineering: Objective s charts, THERBLIC sampling, Numerical. ce Management: Prod tivity, Strategies for in payment schemes, Be Number of lectures = 12 ilysis: Fixed & variable Standard costing, Co- ncy, Break even Ana mportance of material ing - Simple & Weig asic Concept, its relatic ction schedule (MPS)	Title of the unit: Introduces, Method study, Principus, Work measurement - uctivity - Definition, Vario proving productivity, Vario ehavioral aspects, Financia Title of the unit: Manuf Production Planning le costs, Direct, indirect & st control, Cost variance A alysis, Marginal costing a ls in manufacturing industri ghted moving average metions with other decision are , Scheduling Operations V	le of mot various r us method ious method ious method incentive acturing overhead analysis - & contrib ies, Relev hods, Obj eas, Decis	nethods, t ls of meas ods of Job es. Cost Ana costs, & Jo Labor, ma ution, Nu ant costs. ectives & ion optior	urement, evaluation lysis and ob costing uterial, over merical.	y PMTS n & mer g erhead i Material & of PPC & mixe
	11. Uni Def met dete Proo Fac ratin Uni Man Rec volu Man Intr Agg stra proo	iii) Understand the o iv) Explain key feat Unit wise detailed of t-1 inition of Industrial hod study - Various ermining time, Work ductivity & Workford tors effecting product ng, Various incentive t - 2 nufacturing Cost Ana every of overheads, ume, rate & efficien nagement: Strategic i oduction to Forecast gregate planning - Ba tegies, Master product duction systems, Gan	concept of Inventory of ures of Industrial and content Number of lectures = 10 Engineering: Objective s charts, THERBLIG sampling, Numerical. ce Management: Prod tivity, Strategies for in payment schemes, Be Number of lectures = 12 Ilysis: Fixed & variable Standard costing, Concy, Break even Ana mportance of material ing - Simple & Weig usic Concept, its relation ction schedule (MPS) tt chart, Introduction	Title of the unit: Introduces, Method study, Principus, Work measurement - uctivity - Definition, Vario nproving productivity, Varie ehavioral aspects, Financia Title of the unit: Manuf Production Planning le costs, Direct, indirect & st control, Cost variance A alysis, Marginal costing a ls in manufacturing industre ghted moving average met ions with other decision are , Scheduling Operations V to JIT, Numerical.	le of mot various r us method ious method ious method lincentive acturing overhead acturing overhead acturing ies, Relev hods, Obj eas, Decis	nethods, t ls of meas ods of Job es. Cost Ana costs, & Jo Labor, ma ution, Nu ant costs. ectives & ion option thods for	urement, evaluation lysis and ob costing uterial, over merical.	y PMTS n & mer g erhead i Material & of PPC & mixe

Purchase discounts, Sensitivity analysis, Inventory control systems - P, Q, S's Systems, Service level, Stock out

risk, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED and three dimensional, Numericals.

Unit – 4	Number of	Title of the unit: Product Quality Management
	lectures = 10	

Product Design and Development: Various Approaches, Product life cycle, Role 3S's – Standardization, Simplification, Specialization, Introduction to value engineering and analysis, Role of Ergonomics in Product Design. Definition of quality, Various approaches, Concept of quality assurance systems, Costs of quality, Statistical quality Control (SQC), Variables & Attributes, X, R, P & C - charts, Acceptance sampling, OC - curve, Concept of AOQL, Sampling plan - Single, Double & sequential, Introduction to TQM & ISO - 9000.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books	Recommended
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Text Book

 Industrial Engineering and organization management by S K Sharma and Swati Sharma (2013) SK Kataria & Sons Publishing House ISBN-13:978-8185749136

- i) Industrial Engineering and production management by Martand Telsang (2006) S Chand; 2nd Revised Edition 2018 edition ISBN-13: 978-8121917735
- ii) Industrial Engineering and Management by O P Khanna Dhanpat Rai Publications (2018) ISBN-13: 978-8189928353.

	Course	Product Design for	L		Т]	P
	Name	Manufacturing					
3.	Course		3		0		0
	Code						
4.	Type of C	ourse (use tick mark)	Core ()	PE (✓)	OE ()	
5.	Pre-		6. Frequency	Even	Odd (✔)	Either	Every
	requisite		(use tick	0		Sem	Sem
	(if any)		marks)			0	0
7.	Total Nun	nber of Lectures, Tutor	ials, Practical (assum	ing 14 wee	ks of one sen	nester)	
	Lectures =	= 42	Tutorials = 0	Practi	cal = 0		
8.	Course De	escription					
9.	Learning i) To expo ii) To intro iii) To teac iv) To expo Course Ou i) Apply develop ii) Possess compor iii) Develop	ose with basics of produce oduce principles and eval h about the manufactural ose with basics of assemb atcomes (COs): customer-oriented, man oment with product desig methods and approache	et design and manufact duation methods of var bility requirements bly processes and DFM ufacturing and life c n principles and struct s for principles and ev new product as per the	uring. ious aspect: IA softward ycle sensit ured design valuation m	s of designing e for case stuc ive approach methodologi ethods of var	i components. lies. to product d es.	lesign an
11.	Unit wise	detailed content					
U	nit-1	Number of lectures = 10	Title of the unit: In	troduction	to Product d	esign	
[ntro	oduction to	Product design: Asimow	's Model - Product de	esign practi	ce in Industry	- Strength con	nsideratio
n p	roduct desig	gn- Design for stiffness a	nd rigidity.		-		
Uı	nit – 2	Number of lectures	Title of the unit: Pr	inciples an	d evaluation	methods	
		= 10					
		valuation methods of var	ious aspects of Design	for X (mac	hining - sheet	metal working	- injectio
Prin	ciples and e	variation methods of var	1 0			-	
	_	onment- service and repa					

Unit – 4	Number of lectures	Title of the unit: Assembly and assembly process and Other
	= 12	supporting techniques
Assembly and	assembly process - prin	ciples of Design for assembly and applications (Boothroyd/Dewhurst
Method - case	studies using DFMA soft	tware).
Other supporti	ng techniques for new pro	oduct development processes such as quality function deployment - and
quality engine	ering and Taguchi Method	1
12. Brief Des	cription of self-learning	/ E-learning component
The students w	vill be encouraged to learn	using the SGT E-Learning portal and choose the relevant lectures
delivered by su	bject experts of SGT Uni	versity.
	; Patents in the respective	field.
13. Books Re	commended	
Text Book		
i) Geoffr	ey Boothroyd, Peter De	ewhurst and Winston Anthony Knight (2009), Product Design for
Manuf	acture and Assembly, Tay	ylor & Francis e-Library. ISBN: 978-1-420-08927-1.
Reference Bo	oks	
	Chitale and R.C. Gupta, (2 ISBN: 9788120342828	2005), Product Design and Manufacturing, 6th Edition, Printice Hall of
	7. Ulrich and Steven D. 1 aw, ISBN: 978939011323	Eppinger (2011), Product Design and Development, 7th Edition, Tata

		lechanical E	ngineering				
2. Course	Advance	L	8 8	Т		Р	
Name	Materials						
3.Course		3		0		0	
Code		_		-			
4. Type of Cou	urse (use tick	Core	0	PF	E (✔)	OE ()	
mark)	[*]		•			~	
5. Pre-	Material	6. Fr	equency	Even	Odd	Either	Every
requisite (if	Engineering		se tick	0	(✔)	Sem ()	Sem ()
any)	and	ma	arks)	0	. ,	~	Č.
	Technology		,				
7. Total Nu	mber of Lecture	s, Tutorials,	Practical (a	ssuming	14 weel	s of one semest	ter)
Lectures	= 42	Tutorials =	= 0	Pr	actical =	= 0	
8. Course D	escription	•					
Introduction to	the materials s	science and	engineering	of cerai	nics, ele	ectronic materia	ils, metals and
polymers. Bor	nding; crystallog	raphy; imp	erfections; p	processing	g and j	properties of s	emiconductors,
polymers, meta	als, ceramics and	composites; a	and phase dia	grams. T	he cours	e is intended to	give the student
a broad scope p	preparation in sele	ecting and us	ing materials	for appl	ications	in engineering.	-
9. Learning	objectives:						
i) To pro	vide the knowled	ge of advanc	ed materials	and prod	uction te	chnology.	
	terization of mate						e materials.
	pment and applic						
iv) To giv	e the understanding	ng of Nanom	aterials				
	Dutcomes (COs):			the stude	nt will b	e able to:	
	materials for spec						
	materials by prop	. .		ed select	ion, with	special attentio	ns to
	ations in engineer		•			•	
**	Ų	Ų					
iii) Extend	l their in-depth kn	owledge of a	one of the fol	lowing s	pecializa	tions: - Metals a	and Ceramics; -
						tions: - Metals aterials	and Ceramics; -
Semico	onductor Processi	ng and Nano	technology,	or - Biob			and Ceramics; -
Semico iv) Apply		ng and Nano	technology,	or - Biob			and Ceramics; -
Semico iv) Apply 11. Unit wise o	onductor Processi the knowledge of letailed content	ng and Nano Nanomateri	technology, als in Industr	or - Biob y.	ased Ma	terials	and Ceramics; -
Semico iv) Apply	onductor Processi the knowledge of letailed content Number	ng and Nano Nanomateri	technology,	or - Biob y.	ased Ma	terials	and Ceramics; -
Semico iv) Apply 11. Unit wise o Unit-1	onductor Processi the knowledge of detailed content Number lecture	ng and Nano Nanomateri er of es = 10	technology, als in Industr Title of t	or - Biob :y. he unit:]	ased Ma	terials	
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl	onductor Processi the knowledge of detailed content Numbe lecture lassification: Poly	ng and Nano Nanomateri er of es = 10 vmer matrix of	technology, als in Industr Title of the composites, r	or - Biob y. he unit: I netal mat	ased Ma	terials ction posites, ceramic	matrix
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, car	onductor Processi the knowledge of detailed content Number lecture	ng and Nano Nanomateri er of es = 10 vmer matrix of	technology, als in Industr Title of the composites, r	or - Biob y. he unit: I netal mat	ased Ma	terials ction posites, ceramic	matrix
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, car applications.	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com	ng and Nano $rac{1}{2}$ Nanomateri er of es = 10 ymer matrix of posites, fiber	Title of the composites, reinforced	or - Biob y. he unit: I netal mat composit	ased Ma Introduce Trix comp Trix comp	terials Etion posites, ceramic ature-made com	matrix
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, cat applications. Fibres- glass, s	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com	ng and Nano Nanomateri er of es = 10 mer matrix of posites, fiber on, boron, si	Title of the composites, reinforced	or - Biob y. he unit: I netal mat composit	Introduce Introduce Trix comp Trix comp Trix comp Trix comp Trix comp Trix comp Trix comp Trix comp	terials c tion posites, ceramic ature-made com e fibres.	matrix posites, and
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo	onductor Processi the knowledge of detailed content Numbe lecture lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas	ng and Nano Nanomateri er of es = 10 mer matrix of posites, fiber on, boron, si	Title of the composites, reinforced	or - Biob y. he unit: I netal mat composit	Introduce Introduce Trix comp Trix comp Trix comp Trix comp Trix comp Trix comp Trix comp Trix comp	terials c tion posites, ceramic ature-made com e fibres.	matrix posites, and
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, cat applications. Fibres- glass, s	onductor Processi the knowledge of detailed content Numbe lecture lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas	ng and Nano \vec{S} Nanomateri \vec{S} of \vec{S} = 10 \vec{S} mer matrix of posites, fiber on, boron, si stics, thermos	Title of the composites, reinforced licon carbide	or - Biob y. he unit: I netal mat composit c, and bor cs, manut	Introduction Intro	terials etion posites, ceramic ature-made com e fibres. of PMC, MMC	matrix posites, and
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo their applicatio	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns.	ng and Nano \hat{S} Nanomateri er of es = 10 where matrix of posites, fiber on, boron, si stics, thermose er of	Title of the composites, reinforced licon carbide	or - Biob y. he unit: I netal mat composit c, and bor cs, manut	Introduction Intro	terials c tion posites, ceramic ature-made com e fibres.	matrix posites, and
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, cat applications. Fibres- glass, s Polymer compo their applicatio Unit – 2	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns. Number lecture	ng and Nano Nanomateri er of es = 10 mer matrix of posites, fiber on, boron, si stics, thermos er of es = 10	Title of the setting plastic	or - Biob y. he unit: 1 netal mat composit composit composit a, and bor cs, manut he unit: 1	Introduce Trix comp Trix c	terials ction posites, ceramic ature-made com e fibres. f of PMC, MMC cturing Method	matrix aposites, and & CCC and
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo their applicatio Unit – 2 Autoclave, tapo	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns. Number	ng and Nano Nanomateri er of es = 10 mer matrix of posites, fiber on, boron, si stics, thermose er of es = 10 Idding metho	Title of the setting plastic ds, filament	or - Biob y. he unit: I netal man composit c, and bor cs, manut he unit: I winding,	Introduction Introduction Introduction Introduction Introduction Internation Internation Internation Internation Introduct	terials etion posites, ceramic ature-made com e fibres. c of PMC, MMC cturing Method up, pultrusion, R	matrix posites, and & CCC and s
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, cat applications. Fibres- glass, s Polymer compo their applicatio Unit – 2	onductor Processi the knowledge of letailed content Numbe lecture lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns. Numbe lecture e production, mou	ng and Nano $rac{1}{2}$ Nanomateri er of es = 10 mer matrix of posites, fiber on, boron, si stics, thermose er of es = 10 ilding metho er of	Title of the setting plastic ds, filament	or - Biob y. he unit: I netal man composit c, and bor cs, manut he unit: I winding,	Introduction Introduction Introduction Introduction Introduction Internation Internation Internation Internation Introduct	terials ction posites, ceramic ature-made com e fibres. f of PMC, MMC cturing Method	matrix posites, and & CCC and s
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo their applicatio Unit – 2 Autoclave, tape Unit – 3	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns. Number e production, mout Number	ng and Nano $rac{2}{2}$ Nanomateri er of $rac{2}{2}$ s = 10 mer matrix of posites, fiber on, boron, si stics, thermose er of es = 10 ilding metho er of es = 8	technology, als in Industr Title of th composites, r - reinforced licon carbide setting plastic Title of th ds, filament Title of th	or - Biob y. he unit: 1 netal mat composit composit a, and bor cs, manut he unit: 1 winding, he unit: 1	Introduce Trix comp tes and n facturing Manufae Manufae man lay Functior	terials ction posites, ceramic ature-made com e fibres. f of PMC, MMC cturing Method up, pultrusion, R hally Graded M	matrix posites, and & CCC and s TM. aterials
Semico iv) Apply 11. Unit wise o Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo- their applicatio Unit – 2 Autoclave, tape Unit – 3 Types of fur	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns. Number lecture e production, moto lecture	ng and Nano \vec{S} Nanomateri \vec{S} Nanomateri \vec{S} S = 10 \vec{S} mer matrix of posites, fiber on, boron, si stics, thermose \vec{S} = 10 \vec{S} s = 10 \vec{S}	technology, als in Industr Title of th composites, r composites, r reinforced licon carbide setting plastic Title of th ds, filament Title of th classification	or - Biob y. he unit: 1 netal mat composit c, and bor cs, manut he unit: 1 winding, he unit: 1 n-differer	Introduce Trix comp tes and n facturing Manuface Manuface Tunction	terials ction posites, ceramic ature-made com e fibres. of PMC, MMC cturing Method up, pultrusion, R hally Graded M ms-preparation-	matrix posites, and & CCC and s CTM. [aterials properties and
Semico iv) Apply 11. Unit wise of Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo their application Unit -2 Autoclave, tape Unit -3 Types of fur applications of	onductor Processi the knowledge of letailed content Numbe lecture lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns. Numbe lecture e production, mou lecture functionally gradee	ng and Nano Nanomateri er of es = 10 mer matrix of posites, fiber on, boron, si stics, thermose er of es = 10 Ilding metho er of es = 8 d materials- ded material	technology, als in Industriation Title of the set of th	or - Biob y. he unit: I netal man composition a, and bor cs, manutics he unit: I winding, he unit: I n-differer pn-shape	Introduce Introduce Trix completes and n in carbide facturing Manuface Manu	terials etion posites, ceramic ature-made com e fibres. c of PMC, MMC cturing Method up, pultrusion, R hally Graded M ms-preparation- y effect- classifie	matrix posites, and & CCC and s CTM. [aterials properties and
Semico iv) Apply 11. Unit wise of Unit-1 Introduction, cl composites, cat applications. Fibres- glass, s Polymer compo- their application Unit – 2 Autoclave, tape Unit – 3 Types of fur applications of memory alloys	onductor Processi the knowledge of letailed content Number lassification: Poly rbon-carbon com ilica, kevlar, carb osites, thermoplas ns. Number lecture e production, mout lecture functionally gradeed functionally gradeed funct	ng and Nano $rac{1}{2}$ Nanomateri er of $rac{2}{2}s = 10$ mer matrix of posites, fiber on, boron, si stics, thermose er of $rac{2}{2}s = 10$ ilding metho er of $rac{2}{2}s = 8$ d materials- ded material perties and a	technology, als in Industriation Title of the set of th	or - Biob y. he unit: 1 netal mat composit a, and bor cs, manut he unit: 1 winding, he unit: 1 n-differer on-shape f shape r	Introduce Introduce Trix complete Trix complete and n facturing Manuface Ma	terials etion posites, ceramic ature-made com e fibres. of PMC, MMC eturing Method up, pultrusion, R hally Graded M ms-preparation- y effect- classifie alloys.	matrix posites, and & CCC and s TM. [aterials properties and
Semico iv) Apply 11. Unit wise of Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo their application Unit -2 Autoclave, tape Unit -3 Types of fur applications of	onductor Processi the knowledge of letailed content Number lassification: Poly rbon-carbon com ilica, kevlar, carb osites, thermoplas ns. Number lecture e production, mou lecture functionally graded functionally graded Number hereition letters Number lecture notionally graded Number Number Number lecture notionally graded Number Number Number lecture notionally graded Number Number Number lecture notionally graded Number Number lecture lecture Number lecture lectur	ng and Nano $rac{2}$ Nanomateri er of $rac{2}$ s = 10 mer matrix of posites, fiber on, boron, si stics, thermos er of es = 10 ilding metho er of es = 8 d materials- ded material perties and a er of	technology, als in Industrian Title of the setting plastic Composities, respectively,	or - Biob y. he unit: 1 netal mat composit a, and bor cs, manut he unit: 1 winding, he unit: 1 n-differer on-shape f shape r	Introduce Introduce Trix complete Trix complete and n facturing Manuface Ma	terials etion posites, ceramic ature-made com e fibres. of PMC, MMC eturing Method up, pultrusion, R hally Graded M ms-preparation- y effect- classifie alloys.	matrix posites, and & CCC and s TM. [aterials properties and
Semico iv) Apply 11. Unit wise of Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo- their applicatio Unit – 2 Autoclave, tape Unit – 3 Types of fur applications of memory alloys Unit – 4	onductor Processi the knowledge of detailed content Number lassification: Poly rbon–carbon com ilica, kevlar, carb osites, thermoplas ns. Number lecture e production, mou lecture functionally graded functionally functionally	ng and Nano \vec{S} Nanomateri \vec{S} Nanomateri \vec{S} S = 10 \vec{S} mer matrix of posites, fiber on, boron, si stics, thermose \vec{S} = 10 \vec{S} s = 10 \vec{S} s = 10 \vec{S} s = 10 \vec{S} d materials- ded materials- ded materials- ded materials- ded materials \vec{S} s = 8 \vec{S} = 8 \vec{S} s	technology, als in Industriation Title of the setting plastice Title of the setting plastice Title of the setting plastice Composities, respectively, r	or - Biob y. he unit: 1 netal mat composite and bor cs, manut he unit: 1 winding, he unit: 1 n-different on-shape f shape r he unit: 1	Introduce Introduce Trix completion Trix completion T	terials ction posites, ceramic ature-made com e fibres. of PMC, MMC cturing Method up, pultrusion, R hally Graded M ms-preparation- y effect- classified alloys. aterials	matrix posites, and & CCC and s TM. [aterials properties and cation of shape
Semico iv) Apply 11. Unit wise of Unit-1 Introduction, cl composites, car applications. Fibres- glass, s Polymer compo their application Unit – 2 Autoclave, tape Unit – 3 Types of fur applications of memory alloys Unit – 4 Introduction-pr	onductor Processi the knowledge of letailed content Number lassification: Poly rbon-carbon com ilica, kevlar, carb osites, thermoplas ns. Number lecture e production, mou lecture functionally graded functionally graded Number hereition letters Number lecture notionally graded Number Number Number lecture notionally graded Number Number Number lecture notionally graded Number Number Number lecture notionally graded Number Number lecture lecture Number lecture lectur	ng and Nano Nanomateri er of es = 10 mer matrix of posites, fiber on, boron, si stics, thermose er of es = 10 Ilding metho er of es = 8 d materials- ded materials ded materials ded materials des = 8 scales-advanted and Nano Particle and a pertices and a per	technology, als in Industriation Title of the setting plastice Classification s. Introduction pplications of the set disages & disages	or - Biob y. he unit: I netal mat composit a, and bor cs, manut he unit: I winding, he unit: I n-differer on-shape f shape r he unit: I lvantages	Introduce irix completes and n in carbide facturing Manuface Manuface man lay Function it syste memory nemory a Nano M 	terials etion posites, ceramic ature-made com e fibres. f of PMC, MMC cturing Method up, pultrusion, R hally Graded M ms-preparation- d effect- classifie alloys. aterials tions in compari	matrix posites, and & CCC and s TM. [aterials properties and cation of shape

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13.	Books	Recommended

Text Book

i) Material science and Technology- Cahan.

Reference Books

i) B. Frank L. Matthews and Rees D. Rawlings (1999), Composite Materials: Engineering and Science, Woodhead Publishing.

ii) Ning Hu (2012), Composites and Their Applications, in Tech Publisher

iii) Nano material by A.K. Bandyopadyay, New age Publishers.

Department Electives-II

L	rtment- Mechanical E	ingmeet ing				
2. Course Name	Steam Power	L	L I	Т		P
	Generation					
3. Course Code		3	0)		0
4. Type of Course (u	se tick mark)	Core ()	PE (✓)		OE ()	
5. Pre-requisite (if	Engineering	6. Frequency (use	Even ()	Odd	Either	Every
any)	Thermodynamics	tick marks)		(✔)	Sem ()	Sem ()
7. Total Number of I	ectures, Tutorials, P	ractical (assuming 14 we	eks of one	semester)	
Lectures = 42		Tutorials = 0	Practica	$\mathbf{l} = 0$		
8. Course Description	n					
	•	s power generation units a		•		students
-	-	thods in order to make the			-	
-	ntry. To enable student	ts, understand functioning	of boilers,	turbines a	and pumps	used in
power generation.						
9. Learning objective						
	e efficiency of thermal					
	orking of boilers and tu	irbines.				
iii) To learn variou						
	wledge of global energ	gy resources.				
10. Course Outcomes	· /	1				
—		alternate source of energy		1. 1.11		
	÷	used in various industries	-	-	-	
-	—	generation units and choo	ose one th	at meets	desired e	conomic,
	and social requirement					
11. Unit wise detailed	ic power generation ty	pes and steam cycles.				
	1	T:41 f 41				
Unit-1	Number of lectures = 10	Title of the unit: Descri	puon of B	oner		
Classification and type		ents of main boiler, fund	amontals	f boiler	design lo	cation of
various pressure parts.	s of boners, arrangem	ients of main boner, func	amentais	of boller	uesigii, io	
1 1	rv. Water walls boilin	g phenomena, nucleate / fr	lm hoiling	natural /	controlled	1 / forced
	•	leaters, Re-heaters, and H	-			
Separation Theory: Boi	-		×011011112CI	5, DC 50	per neuter	5. Dieum
Septementon Interije 201						
Unit – 2			turbine a	nd conde	nser	
Unit – 2	Number of lectures = 11	Title of the unit: Steam	turbine a	nd conde	nser	
	Number of lectures = 11	Title of the unit: Steam			nser	
Water Supply System:	Number oflectures = 11Soft water, Circulated V	Title of the unit: Steam Water, Cooling Water, and	D.M. Wat	er.		V, steam
Water Supply System: Steam Cycle Theory:	Number oflectures = 11Soft water, Circulated V	Title of the unit: Steam	D.M. Wat	er.		W, steam
Water Supply System: Steam Cycle Theory: properties.	Number oflectures = 11Soft water, Circulated VCarnot Cycle, Ranking	Title of the unit: Steam Water, Cooling Water, and	D.M. Wat	er. c unit 50	0/210 MV	W, steam
Water Supply System: S Steam Cycle Theory: properties. Steam Turbines: Classic	Number of lectures = 11 Soft water, Circulated V Carnot Cycle, Ranking Tication of Turbines, M	Title of the unit: Steam Water, Cooling Water, and e Cycle, with reference to	D.M. Wat a specifi	er. c unit 50 principles	0/210 MV	
Water Supply System: S Steam Cycle Theory: properties. Steam Turbines: Classic	Number of lectures = 11 Soft water, Circulated V Carnot Cycle, Ranking Fication of Turbines, M mponents i.e. Turbine	Title of the unit: Steam Water, Cooling Water, and e Cycle, with reference to etallurgical considerations casing, Steam Condensat	D.M. Wat a specifi	er. c unit 50 principles	0/210 MV	
Water Supply System: S Steam Cycle Theory: O properties. Steam Turbines: Classic Description of main co	Number of lectures = 11 Soft water, Circulated V Carnot Cycle, Ranking Fication of Turbines, M mponents i.e. Turbine	Title of the unit: Steam Water, Cooling Water, and e Cycle, with reference to etallurgical considerations casing, Steam Condensat	D.M. Wat a specifi , working ion and Co	er. c unit 50 principles ondensers	0/210 MV	
Water Supply System: S Steam Cycle Theory: o properties. Steam Turbines: Classif Description of main co wise condensation, dire	Number of lectures = 11Soft water, Circulated V Carnot Cycle, RankingSication of Turbines, M mponents i.e. Turbine ct/indirect condensatio	Title of the unit: Steam Water, Cooling Water, and e Cycle, with reference to etallurgical considerations casing, Steam Condensat n and vacuum creation	D.M. Wat a specifi , working ion and Co	er. c unit 50 principles ondensers	0/210 MV	
Water Supply System: S Steam Cycle Theory: O properties. Steam Turbines: Classif Description of main co wise condensation, dire Unit – 3	Number of lectures = 11Soft water, Circulated V Carnot Cycle, RankingSication of Turbines, M mponents i.e. Turbine ct/indirect condensatioNumber of lectures = 09	Title of the unit: Steam Water, Cooling Water, and e Cycle, with reference to etallurgical considerations casing, Steam Condensat n and vacuum creation	D.M. Wat b a specifi , working ion and Co Station P	er. c unit 50 principles ondensers	0/210 MV	
Water Supply System: S Steam Cycle Theory: O properties. Steam Turbines: Classif Description of main co wise condensation, dire Unit – 3	Number of lectures = 11 Soft water, Circulated V Carnot Cycle, Ranking Fication of Turbines, M mponents i.e. Turbine ct/indirect condensatio Number of lectures = 09 , centrifugal pumps, ar	Title of the unit: Steam Water, Cooling Water, and e Cycle, with reference to etallurgical considerations casing, Steam Condensat n and vacuum creation Title of the unit: Power and positive displacement p	D.M. Wat b a specifi , working ion and Co Station P	er. c unit 50 principles ondensers	0/210 MV	

Unit – 4	Number of	Title of the unit: Various Fans and their salient
	lectures = 12	features

Construction details / lubricating oil system for PA Fan, FD Fan, ID Fan.

Air Pre-heaters: Types and functions, constructional details, SCAPH, soot blowers.

Fuel Firing Arrangements and Burners: Corner, front and rear wall firing, Direct and indirect firing, details of coal and oil burners

12. Brief Description of self-learning / E-learning component

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The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i)	R. K. Rajput, (2007), A Text Book of Power Plant Engineering, Laxmi Publications (P) Ltd. 5 th Edition.	
	ISBN 13: 9788131802557	

Reference Books

i)	P. K. Nag, (2014), Power Plant Engineering: Steam and Nuclear, Tata McGraw-Hill Publishing
	Company Ltd., 4 th EditionISBN13 9789339204044.
ii)	Wood, A.J. and Wollen Berg, B.F. (2013), Power Generation and Control, John Wiley, 3 rd Edition,

ISBN: 978-0-471-79055-6

1.	Name of the	Department- Mech	ianical Engineering					
2.	Course	Production	L		Т		Р	
	Name	Planning and						
		Control						
3.	Course		3		0		0	
	Code		C		Ŭ		U U	
4	Type of Cou	rse (use tick	Core ()	PE (✓)	OE ()		
4.	mark)	ise (use lick	Core ()	112(*)	OE ()		
5	Pre-	IE	6. Frequency Even () Odd (✓) Either Sem Every Set					
5.		IE		Even ()	Ouu (•)		Every Sem	
	requisite		(use tick			0	0	
-	(if any)		marks)	• 14	1 6			
7.			orials, Practical (assu	_		semester)		
-	Lectures $= 4$		Tutorials = 0	Pracu	cal = 0			
	Course Desc	1						
	-		ning sets the objectiv					
	•		is the integral part			•		
asse	essment of the	performance; such a	assessment can be ma	de effectivel	y only when	n some standar	rds are set in	
adva	ance. Planning	g involves setting u	p to such standard.	The controlli	ng is made	by comparin	g the actual	
perf	formance with	these present standar	rd and deviations are	ascertained a	nd analyzed			
9.	Learning ob	jectives:						
	i) Identify an	nd suggest correct ty	pe of production plan	ning techniq	le			
	-	he concepts of produ		0 1				
	-		nethods in crucial area	s of the indu	strv.			
		-	ERP systems and shop		-			
	-		mpletion of this cours		-	le to		
			production planning			10 10		
	-	nowledge of type of nowledge of of proc		acennique				
	-	• •		mathada in a		of the industr	.,	
	-	-	l and implement PPC				•	
	-		nent the knowledge of	ERP system	is and shop I	lloor schedung	ig.	
		tailed content	ſ					
Uni	t-1	Number of	Title of the unit: M	PC Perform	ance			
		lectures = 10						
Fact	tors influencin	g MPC performance	e - Review of fundar	nental featur	es of Mater	ial Requireme	nts Planning	
syst	ems - MRP sy	stems dynamics and	system nervousness.					
Unit – 2 Number of Title of the unit: Sales and Operations Planning								
UIII	t – 2	Number of	Title of the unit: Sa	les and Ope	rations Pla	nning		
UIII	t – 2	Number of lectures = 11	Title of the unit: Sa	les and Ope	erations Pla	nning		
		lectures = 11	Title of the unit: Sa action Planning - Ma				Distribution	
Sale	es and operation	lectures = 11		ster scheduli	ng and orde	er promising -		
Sale Res	es and operation	lectures = 11	action Planning - Ma	ster scheduli eduling - and	ng and orde I final assen	er promising -		
Sale Res	es and operation ource Planning	lectures = 11 ons planning - Produ g - Bills of material s	action Planning - Ma tructuring, master sch	ster scheduli eduling - and	ng and orde I final assen	er promising -		
Sale Res Uni	es and operatio ource Planning t – 3	lectures = 11 ons planning - Produ g - Bills of material s Number of lectures = 11	action Planning - Ma tructuring, master sch Title of the unit: C	ster scheduli eduling - and apacity Man	ng and orde 1 final assen agement	er promising - nbly schedulin	g.	
Sale Res Uni	es and operation ource Planning t – 3 pacity manager	lectures = 11 ons planning - Produ g - Bills of material s Number of lectures = 11 nent using planning p	action Planning - Ma tructuring, master sch	ster scheduli eduling - and apacity Man ity - and capa	ng and orde 1 final assen agement acity require	er promising - nbly schedulin	g.	
Sale Res Uni Cap I/O	es and operation ource Planning t – 3 pacity manager	lectures = 11 ons planning - Produ g - Bills of material s Number of lectures = 11 nent using planning p	uction Planning - Ma structuring, master sch Title of the unit: C factors - bills of capac	ster scheduli eduling - and apacity Man ity - and capa entory mode	ng and orde d final assen agement acity require ls.	er promising - nbly schedulin ements plannin	g.	

Shop floor control/scheduling - Kanban/pull systems - Alternative pull systems; parameter settings - Pull systems for suppliers.

ERP systems - Technical aspects of SAP - Focus on implementation and system's fit - ERP implementation - Beyond ERP Software for manufacturing firms - Supply Chain Management.

12. Brief Description of self-learning / E-learning component

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The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

 D.W. Fogarty, J.H. Blackstone and T. Hoffmann. (2009), Production and Inventory Management, 3rd Edition, South-Western Publishing. ISBN: 978-0-324-31137-2

Reference Books

- i) S. K Mukhopadhyay (2009), Production Planning and Control: Text and Cases, 2nd Edition, Phi Learning. ISBN: 978-8-120-33118-1
- **ii**) Stephen N. Chapman (2005), Fundamentals of Production Planning and Control, Prentice Hall. ISBN: 978-0-130-17615-8.

1.	Name of th	e Department- Mecha	nical Engineering					
2.	Course	Fuel and	L		Т		Р	
	Name	Combustion						
3.	Course		3	0			0	
	Code							
4.	Type of Co	urse (use tick mark)	Core ()	PE (✓) OE ()				
5.	Pre-	Engg.	6. Frequency			Every Sem		
	requisite	Thermodynamics	(use tick			0	0	
	(if any)		marks)					
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)								
Lectures = 42Tutorials = 0Practical = 0								
8.	Course Des	scription						
Two	and four s	troke engines, air stan	dard cycles, fuels a	and combust	ion, fundam	ental of ignit	ion systems,	
perf	ormance and	rating of engines, com	bustion characteristi	cs and comb	ustion cham	ber for S.I and	C.I engines,	
	ercharging.							
9.	Learning o	•						
		about various types of	-		erties			
	· •	re depth knowledge of		eous fuels.				
		rstand the thermodynan						
		about the types of poll						
10.		tcomes (COs): On com	-			le to		
	-	the composition of var	• •					
		the composition of var	• •		erties.			
		trate the knowledge of		-				
		the knowledge of Stoic	chiometry of Fuel and	d Kinematics	of Combus	tion.		
		etailed content						
Uı	nit-1	Number of	Title of the unit: F	uel Charact	eristics & A	Air Pollution		
		lectures = 10						
	• •	and Characteristics of F		-		-		
		Analysis - Moisture E						
		DuLong's Formula for			sis - Orssat	Apparatus - F	uel and Ash	
	-	Indling – Spontaneous			oin n a 11	Dollard	f food!1 foot	
	•	ution - Combustion-Ge	-		air pollution	1 - Pollution 0	1 IOSSII TUEIS	
		- Pollution from autom						
U	nit — 2	Number of lectures = 11	Title of the unit: S	ond and Li	luia rueis			
S -	lid Eucles W	vood and Wood Chard	coal Origin of coal	Composition	of cost	nalucia and	properties of	
		s of coal preparation a	-	-		•		
	-	s of coal preparation a s-Production –Compos	-	-	-		-	
-		lcohol shale oil-Gasifi		-	-	-	-	
	els.	iconor shale on-Gasin	cation of inquite fuel	5 Synthetic	10015 -51016		ing or inquid	
	$\frac{1}{1} - 3$	Number of	Title of the unit: (aseons Fue	s			
		lectures = 10						
Cl	assification -	Composition and Prop	erties – Estimation of	of Calorific V	alue - Gas (Calorimeter. R	ich and	
		• •						
	Lean Gas - Wobbe Index - Natural Gas - Dry and Wet Natural Gas - Stripped NG - Foul and Sweet NG -							

LPG - LNG - CNG - Methane – Producer Gas - Gasifies - Water Gas – Town Gas - Coal Gasification – Gasification Efficiency - Non - Thermal Route - Biogas - Digesters -Reactions – Viability - Economics.

Unit – 4	Number of	Title of the unit: Stoichiometry and Kinematics
	lectures = 11	

Stoichiometry - Mass Basis and Volume Basis – Excess Air Calculation - Fuel and Flue Gas Compositions – Calculations – Rapid Methods - Combustion Processes - Stationary Flame – Surface or Flameless Combustion – Submerged Combustion – Pulsating and Slow Combustion Explosive Combustion. Mechanism of Combustion – Ignition and Ignition Energy - Spontaneous Combustion - Flame Propagation - Solid - Liquid and Gaseous Fuels Combustion - Flame Temperature - Theoretical - Adiabatic and Actual - Ignition Limits – Limits of inflammability.

12. Brief Description of self-learning / E-learning component

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The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Books

- i) Stephen Turns, (2011), an Introduction to Combustion: Concepts and Applications, McGraw Hill. McGraw-Hill Education; 3 Edition, ISBN: 978-0073380193
- ii) SS Thipse (2010) Alternative Fuels. Jaico Publishers, 1st Edition, ISBN: 9788184950786

Reference Books

- i) John B. Heywood (2017)– Internal Combustion Engine, McGraw Hill. 1 edition, ISBN-13: 978-1259002076
- ii) Mishra, D. P, (2007), Fundamentals of Combustion, Prentice Hall of India. Revised Edition ISBN 13: 9788120333482

-		tment- Mechanical E			_	1	_
2.	Course Name	Estimation & Costing	L	ן	ſ]	P
3.	Course Code		3	()	(0
4. '	Type of Course (us	e tick mark)	Core ()	PE (✓)		OE ()	
5.	Pre-requisite (if	Nil	6. Frequency (use	Even ()	Odd	Either	Every
	any)		tick marks)		(✔)	Sem ()	Sem ()
7. 7	Total Number of L	ectures, Tutorials, Pi	ractical (assuming 14 wee	ks of one	semester))	
Lect	tures = 42		Tutorials = 0	Practica	l = 0		
8.	Course Description			L			
This	is a course in Estimation	ation & Costing is a ne	ew approach for product co	ost estimati	ing in mec	hanical p	roduction
is pr	roposed within the fr	amework of integrate	d product engineering. The	e approach	n introduce	es the new	v concep
of C	Cost Entity. It is ma	ade necessary due to	the current context of g	rowth of	indirect c	costs, espe	ecially in
man	ufacturing. The obj	ective, i.e., establishi	ng a tight link between	technical	variables	(or manu	facturing
featu	ures) and economic	variables (modeled a	s Cost Entities), requires	to model t	the reason	ing proce	dure and
asso	ciated knowledge re	lated to cost estimatin	g.				
9.]	Learning objectives						
		•	s of Engineering Costing &		0		
i	ii) To address the u	inderlying concepts, n	nethods and application of	Engineerii	ng Costing	g & Estim	ating.
i	iii) Understanding t	he concept of Depreci	ation & Break-Even Analy	sis and Es	stimating		
i	iv) The student can	identify different area	s of Budgetary control, see	curing flex	ibilities o	f budgetin	ıg.
10.	Course Outcomes (COs):					
		·	n knowledge of Engineerin	g Costing	& Estima	ting.	
i	i) To present a pro	blem oriented in depth	n knowledge of Engineerin nethods and application of 1			-	ating.
i i	i) To present a proii) To address the u	blem oriented in depth nderlying concepts, m		Engineerir	ng Costing	-	ating.
i i i	i) To present a proii) To address the uiii) Understanding the standing the standing the standing the standing the standing the standing the standard standard	blem oriented in depth nderlying concepts, m he concept of Depreci	hethods and application of	Engineerir sis and Es	ng Costing timating	g & Estim	ating.
i i i	i) To present a proii) To address the uiii) Understanding the standing the standing the standing the standing the standing the standing the standard standard	blem oriented in depth nderlying concepts, m he concept of Depreci he concept of Budget,	nethods and application of a ation & Break-Even Analy	Engineerir sis and Es	ng Costing timating	g & Estim	ating.
i i i	 i) To present a pro ii) To address the u iii) Understanding the understandi	blem oriented in depth nderlying concepts, m he concept of Depreci he concept of Budget,	nethods and application of a ation & Break-Even Analy	Engineering sis and Es	ng Costing timating	g & Estim	ating.
i i i 11.	 i) To present a pro ii) To address the u iii) Understanding the understandi	blem oriented in deptl nderlying concepts, m he concept of Depreci he concept of Budget, content	nethods and application of ation & Break-Even Analy Budgetary Control and En	Engineering sis and Es	ng Costing timating	g & Estim	ating.
i i 11. Unit	 i) To present a pro ii) To address the u iii) Understanding the understandi	blem oriented in deptl nderlying concepts, m he concept of Depreci he concept of Budget, content Number of lectures = 10	nethods and application of ation & Break-Even Analy Budgetary Control and En	Engineerir rsis and Es rgineering uction	ng Costing timating Contracts	g & Estim	
i i 11. Unit Rela	 i) To present a proi ii) To address the u iii) Understanding the unit of th	blem oriented in depth nderlying concepts, m he concept of Depreci he concept of Budget, content Number of lectures = 10 distimating, Importance	nethods and application of ation & Break-Even Analy Budgetary Control and En Title of the unit: Introdu	Engineerin rsis and Es gineering uction	ng Costing timating Contracts organizat	g & Estim	stimatin
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Definition, Different types, Methods adopted for estimation, Use of Standard data, parameter estimating, statistical estimating, feedback systems, importance, purpose and functions of estimating, Menstruation.

Unit – 4	Number of	Title of the unit: Budget, Budgetary Control And
	lectures = 12	Engineering Contracts

Budget, objectives, classification of budgeting, Budgetary control, securing flexibilities of budgeting, limitation of budget. Operational and capital budgets, Cash flow schedules, estimating cost, Preparing an annual budget for the Engineering Department. Introduction, Types of contracts and similarities. Terms of payments, firm price contracts, cost reimbursable contracts, Target of cost contracts

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books H	Recommended
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Text Book

i) Mechanical Estimating and Costing By B.P. Sinha. Tata McGraw Hill Publishing Co. Ltd. N. Delhi ISBN: 0133800202

Reference Books

i) Mechanical Estimating and Costing T.R. Banga and S.C.Sharma, Khanna Publishers, Delhi-6

- ii) Industrial Engineering & Operations management by S.K.Sharma & Savita Sharma, Kataria publishers ISBN: 1412918057
- iii) Handbook of Engineering Management- Edited by Dennis Lock, Butterwork & Heinemanky Ltd., ISBN: 0470942185

1.	Name of the Depart	tment- Mechanical E	Ingineering					
2.	Course Name	Total Quality Management	L]	ſ]	Р	
3.	Course Code	-	3	0		0		
4.	Type of Course (us	e tick mark)	Core ()	PE (✓)		OE ()		
5.	Pre-requisite (if	Industrial	6. Frequency (use	Even ()	Odd	Either	Every	
	any)	Engineering,	tick marks)		(✔)	Sem ()	Sem ()	
		Probability &						
		Statistics.						
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)								
	$\frac{\text{ctures} = 42}{2}$		Tutorials = 0	Practica	$\mathbf{l} = 0$			
8.	Course Description						~	
	•	· ·	d TQM and explaining the	salient co	ntribution	s of Quali	ty Gurus	
		•	ers in implementing TQM.					
9.	Learning objectives		1 1. 6					
			and quality from organizat	-				
			anagement from different sulture, education and train	• •	••			
		nternational/national		ing of the	organizati	011.		
10			l be able to understand					
10.		·	v environment of the organ	ization				
	· •	• • •	•					
ii) The TQM approach for manufacturing/service organization at length.								
	iii) Quality terms like Tolerance and Variability PDCA cycle, Crosby's 10 points and Deming's 14 Points							
				-	nts and D	eming's 1	4 Points	
	etc.	te Tolerance and Varia	ability PDCA cycle, Crosb	-	nts and D	eming's 1	4 Points	
	etc. iv) The internationa	te Tolerance and Varia	ability PDCA cycle, Crosb	-	nts and D	eming's 1	4 Points	
	etc. iv) The internationa Unit wise detailed c	te Tolerance and Variant l/national Quality Star content	ability PDCA cycle, Crosb ndards.	y's 10 poi			4 Points	
	etc. iv) The internationa	te Tolerance and Varia l/national Quality Star content Number of	ability PDCA cycle, Crosb	y's 10 poi			4 Points	
Un	etc. iv) The internationa Unit wise detailed c it-1	te Tolerance and Varia l/national Quality Stat content Number of lectures = 12	ability PDCA cycle, Crosb ndards. Title of the unit: Introd	y's 10 poi	d TQM P	rinciples		
Un Intr	etc. iv) The internationa Unit wise detailed of it-1 roduction – Need for	te Tolerance and Variational Quality States content Number of lectures = 12 quality – Evolution of	ability PDCA cycle, Crosb ndards. Title of the unit: Introd of quality – Definitions of	y's 10 poi uction and f quality –	d TQM P	Principles	oduct and	
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Un Intu ser Cu Co TQ 5s,	etc. iv) The internationa Unit wise detailed of it-1 roduction – Need for vice quality – Basic stomer focus – Custor sts of quality. M, Leadership, Lean Kaizen, Contribution	te Tolerance and Varia I/national Quality Stat content Number of lectures = 12 quality – Evolution of concepts of TQM – mer orientation, Custo and JIT Quality Philos s of Deming, Juran an	ability PDCA cycle, Crosb ndards. Title of the unit: Introd of quality – Definitions of TQM Framework — Bar omer satisfaction, Custome sophy, Strategic quality pla ed Crosby	y's 10 poi uction and f quality – riers to T r complair anning, Qu	d TQM P Dimensio QM – Qu nts, and Cu nality Cou	Principles ons of pro- uality state ustomer re ncils, PDC	oduct and ements – etention – CA cycle,	
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Un Intr ser Cu Co TQ 5s, Un Intr too cha An	etc. iv) The internationa Unit wise detailed of it-1 roduction – Need for vice quality – Basic stomer focus – Custor sts of quality. M, Leadership, Lean Kaizen, Contribution it – 2 roduction to Process Q ls for data representa- urts, Process capability alysis of Experiment	te Tolerance and Varia I/national Quality State content Number of lectures = 12 quality – Evolution of concepts of TQM – mer orientation, Custon and JIT Quality Philon s of Deming, Juran an Number of lectures = 10 Quality, Graphical and ation, Sampling, sam y analysis, Measuremer (DOE)	ability PDCA cycle, Crosb ndards. Title of the unit: Introd of quality – Definitions of TQM Framework — Bar omer satisfaction, Custome sophy, Strategic quality pla od Crosby Title of the unit: T management-I statistical techniques for Pr pling distribution, and hy ent system analysis, Analy	y's 10 poi uction and quality – riers to T r complair anning, Qu tools & rocess Qua pothesis T sis of Vari	d TQM P Dimensio QM – Qu tality Cou ality Cou Techniq ality Impro festing, R ance (AN	Principles ons of pro- uality state ustomer re- ncils, PDC ues for ovement, C egression OVA), De	oduct and ements – etention – CA cycle, Quality Graphical , Control	
Un Intr Ser Cu Co TQ 5s, Un Intr too cha An	etc. iv) The international Unit wise detailed of it-1 roduction – Need for vice quality – Basic stomer focus – Custon sts of quality. M, Leadership, Lean Kaizen, Contribution it – 2 roduction to Process Q ls for data representant strs, Process capability	te Tolerance and Variational Quality State investment Number of lectures = 12 quality – Evolution of concepts of TQM – mer orientation, Custon and JIT Quality Philos s of Deming, Juran and Number of lectures = 10 Quality, Graphical and ation, Sampling, sam y analysis, Measuremer (DOE) Number of luccondent of Number of lectures = 10 Results, Measuremer (DOE)	ability PDCA cycle, Crosb ndards. Title of the unit: Introd of quality – Definitions of TQM Framework — Bar omer satisfaction, Custome sophy, Strategic quality pla ad Crosby Title of the unit: T management-I statistical techniques for Pr pling distribution, and hy ent system analysis, Analy Title of the unit: Tools of	y's 10 poi uction and quality – riers to T r complair anning, Qu tools & rocess Qua pothesis T sis of Vari	d TQM P Dimensio QM – Qu tality Cou ality Cou Techniq ality Impro festing, R ance (AN	Principles ons of pro- uality state ustomer re- ncils, PDC ues for ovement, C egression OVA), De	oduct and ements – etention – CA cycle, Quality Graphical , Control	
Un Intu ser Cu Co TQ 5s, Un Intu too cha An Un	etc. iv) The internationa Unit wise detailed of it-1 roduction – Need for vice quality – Basic stomer focus – Custon sts of quality. M, Leadership, Lean Kaizen, Contribution it – 2 roduction to Process Q ls for data representa urts, Process capability alysis of Experiment of it – 3	te Tolerance and Varia I/national Quality Stat content Number of lectures = 12 quality – Evolution of concepts of TQM – mer orientation, Custo and JIT Quality Philos s of Deming, Juran an Number of lectures = 10 Quality, Graphical and ation, Sampling, sam y analysis, Measureme (DOE) Number of lectures = 10	ability PDCA cycle, Crosb ndards. Title of the unit: Introd of quality – Definitions of TQM Framework — Bar omer satisfaction, Custome sophy, Strategic quality pla ad Crosby Title of the unit: T management-I statistical techniques for Pr pling distribution, and hy ent system analysis, Analy Title of the unit: Tools of management-II	y's 10 poi uction and quality – riers to T r complair anning, Qu Tools & rocess Qua pothesis T sis of Vari & Technic	d TQM P Dimension QM – Quants, and Cuants, and Cuant	Principles ons of pro- uality state ustomer re- ncils, PDC ues for ovement, C egression OVA), De Quality	oduct and ements – etention – CA cycle, Quality Graphical , Control esign and	
Un Intri Ser Co TQ 5s, Un Intri too cha An Un Six	etc. iv) The internationa Unit wise detailed of it-1 roduction – Need for vice quality – Basic stomer focus – Custor sts of quality. M, Leadership, Lean Kaizen, Contribution it – 2 roduction to Process Q Is for data representation its, Process capability alysis of Experiment of it – 3 -sigma for Process In	te Tolerance and Varia I/national Quality State content Number of lectures = 12 quality – Evolution of concepts of TQM – mer orientation, Custor and JIT Quality Philor s of Deming, Juran an Number of lectures = 10 Quality, Graphical and ation, Sampling, sam y analysis, Measuremer (DOE) Number of lectures = 10 nprovement, Quality f	ability PDCA cycle, Crosb ndards. Title of the unit: Introd of quality – Definitions of TQM Framework — Bar omer satisfaction, Custome sophy, Strategic quality pla ad Crosby Title of the unit: T management-I statistical techniques for Pr pling distribution, and hy ent system analysis, Analy Title of the unit: Tools of	y's 10 poi uction and f quality – riers to T r complair anning, Qu Tools & rocess Qua pothesis T sis of Vari & Technic FD), QFD	d TQM P Dimensio QM – Qu nts, and Cu nality Cou Techniq ality Impro Festing, R ance (AN ques for Q process. F	Principles ons of pro- uality state ustomer re- ncils, PDC ues for ovement, C egression OVA), De Quality Failure mo	oduct and ements – etention – CA cycle, Quality Graphical , Control esign and	

Unit – 4	Number of	Title of the unit: Quality Systems				
Cint – 4	lectures $= 10$	The of the unit. Quanty Systems				
	10000105 10					
Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements.						
Quality Audits. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment,						
recognition and rewar	rd- Introduction to softw	vare quality.				
12. Brief Description	n of self-learning / E-le	earning component				
The students will be e	encouraged to learn usin	g the SGT E- Learning portal and choose the relevant lectures				
delivered by subject e	experts of SGT Universi	ty.				
The link to the E-Lear	rning portal.					
Journal papers; Paten	ts in the respective field					
13. Books Recomme	nded					
Text Book						
i) D. C. Montgo 978-0470169	•	Statistical Quality Control, John Wiley & Sons, 3 rd Edition, ISBN-				
Reference Books						
i) Dale H. Bes 97893325344		Quality Management, Third edition, Pearson Education, ISBN-				
ii) Shridhara Bh	at K, Total Quality Mar	agement – Text and Cases, Himalaya Publishing House, ISBN-				
978-8178662	527.					

1. Name of the Depar	tment- Mechanical E	Ingineering		
2. Course Name	Tool Design	L	Т	Р
3. Course Code		3	0	0
4. Type of Course (us	Type of Course (use tick mark) Con		PE (✓)	OE ()
5. Pre-requisite (if any)	Workshop Technology, Manufacturing Process	6. Frequency (use tick marks)	Even () Odd (*)	Either Every Sem () Sem ()
	ectures, Tutorials, P	ractical (assuming 14 wee		r)
Lectures = 42		Tutorials = 0	Practical = 0	
č 1	zed area of manufactu	ring engineering comprising, and procedures necessary	• • •	0 0
 tool design and ii) Implement the to iii) Design, develop iv) Use CAD and co 10. Course Outcomes (i) Understand intro ii) Learn the design iii) Understand med 	engineering. ool design process wh , and evaluate cutting onventional technique COs): At the end of the oduction, regulation of	tructures and its construction materials and testing.	e manufacturing of a manufactured pr ngs. be able to,	f a product
11. Unit wise detailed	content	**		
Unit-1	Number of lectures = 12	Title of the unit: Introd Feeds	uction, Regulation	n of Speed and
Motions in Machine To Feeds: Aim of Speed and	ools, Kinematics of M I Feed Regulation, Step	echanisms: Introduction t lachine Tools, Motion Tra oped Regulation of Speeds, Gear Boxes, Feed Drives, F Title of the unit: Machi	ansmission. Regula Multiple Speed M Feed Box Design.	ation of Speeds and otors, Ray Diagrams
-	gidity, Materials for M	s of Machine Tool Structur Aachine Tool Structures, N dles and Carriages	-	-
Unit – 3	Number of lectures = 10	Title of the unit: Mecha Testing	nical Properties o	of Materials and
	-	ndles: Functions and Types ti-Friction Guideways, Cor	•	

Screws. Design of Spindles and Spindle Supports: Functions of Spindles and Requirements, Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles, Antifriction Bearings.

Unit – 4	Number of	Title of the unit: Advance Material and Application
	lectures = 10	

Dynamics of Machine Tools: Machine Tool Elastic System, Static and Dynamic Stiffness Acceptance Tests, Current industry trends.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Machine Tool Design and Numerical Control/ N.K. Mehta / McGraw Hill Education; 3rd edition, ISBN: 9781259004575

Reference Books

- i) Principles of Machine Tools/ G. C. Sen and A. Bhattacharyya / New Central Book Agency/ASIN-B01FIX1MKA.
- ii) Design of Machine Tools / D. K Pal, S. K. Basu / Oxford /ISBN: 9788120417779/Product Code-EBK0013309.

1. Name	of the Depart	ment- Mechanical Eng	gineering			
2. Course	Composite	L	T	Р		
Name	Materials	-	-	-		
3.Course		3	0	0		
Code		5	, i i i i i i i i i i i i i i i i i i i	0		
	pe of Course	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
(use tick m	-			010		
5. Pre-	MET	6. Frequency	Even ()	Odd	Either	Every Sem ()
requisite		(use tick marks)	Lven ()	(✔)	Sem ()	Livery Senn ()
(if any)		(use tiek marks)			Sem ()	
	umber of Lec	tures, Tutorials, Pract	tical (assuming 14 y	weeks of on	e semester)	
	res = 42	Tutorials = 0	Practical = 0			
8. Course	Description					
Composites	s are a unique	class of materials made	e from two or more	distinct mat	erials that w	hen combined are
		e separately. They are				
		ngth and stiffness when				
composites	. Student will	also get the idea about	t design and manu	facturing me	ethods invol	ved in making of
		hod and failure theori				
-		high-performance mate	erial and expanded c	ommercial a	as well as in	dustrial utilization,
	course is quite	useful.				
	ng objectives:					
		the properties and desig				
		with the manufacturing				
		ne ability to use appropriate				
		ted with practical requi				cturing.
		Os): On completion of		ents will be	able to	
	•	mic aspects of using co				
		anical testing of compo				
	-	inufacture composite m				
	explain the re-	levance and limitations	of the destructive a	and non-des	tructive test	methods used for
	se detailed co	ntent				
Unit-1		mber of lectures $= 10$	Title of the u	nit: Introdu	uction	
		, Reinforcements and n				matrices Types of
	-	ore composites, Proper	• •		• -	• •
·		eramic and polymer ma		in company		undura materiais,
Unit – 2		mber of lectures =11	Title of the u	nit: Manuf	acturing M	ethods
		, press moulding, inj			<u> </u>	
	- oping ing un		ection moulding. re	esin injectic	,,	
					of adhesio	
pultrusion	i, centrifugal c	casting and prepress. F	Fibre/Matrix Interfac	ce, Theories		n; absorption and
pultrusion wetting,	n, centrifugal of Inter diffusion	casting and prepress. F	Fibre/Matrix Interfaction	ce, Theories cal. Measur	ement of i	n; absorption and nterface strength.
pultrusion wetting, Character	n, centrifugal of Inter diffusion	casting and prepress. F	Fibre/Matrix Interfaction	ce, Theories cal. Measur	ement of i	n; absorption and nterface strength.
pultrusion wetting, Character	n, centrifugal of Inter diffusion ization of syste of composite.	casting and prepress. F	Fibre/Matrix Interfaction	ce, Theories cal. Measure or, etc. Influe	ement of i ence of interf	n; absorption and nterface strength. Face on mechanical
pultrusion wetting, Character properties Unit – 3	n, centrifugal of Inter diffusion ization of syste of composite. Nu	casting and prepress. F n, electrostatic, chemi ems; carbon fibre/epoxy	Fibre/Matrix Interfact cal, and mechanic , glass fibre/polyeste Title of the u	ce, Theories cal. Measure or, etc. Influe mit: Mecha	ement of i ince of interf nical Prope	n; absorption and nterface strength. face on mechanical
pultrusion wetting, Character properties Unit – 3 Stiffness	n, centrifugal of Inter diffusion ization of syste of composite. Num and Strength:	casting and prepress. F n, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10	Fibre/Matrix Interfaction cal, and mechanic , glass fibre/polyeste Title of the u volume and weight	ce, Theories cal. Measure or, etc. Influe mit: Mecha fraction. U	ement of i ince of interf nical Prope nidirectiona	n; absorption and nterface strength. face on mechanical rties l continuous fibre,
pultrusion wetting, Character properties Unit – 3 Stiffness discontinu	n, centrifugal of Inter diffusion ization of syste of composite. Num and Strength: lous fibres, S	casting and prepress. In, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10 Geometrical aspects –	Fibre/Matrix Interfaction cal, and mechanic , glass fibre/polyeste Title of the u volume and weight oven reinforcements	ce, Theories cal. Measure or, etc. Influe unit: Mecha fraction. U s – length	ement of i once of interf nical Prope nidirectiona and orienta	n; absorption and nterface strength. face on mechanical rties continuous fibre, tion distributions.
pultrusion wetting, Character properties Unit – 3 Stiffness discontinu Mechanic compressi	n, centrifugal of Inter diffusion ization of syste of composite. Num and Strength: uous fibres, St cal Testing: I ion, flexure ar	casting and prepress. In n, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10 Geometrical aspects – hort fibre systems, we Determination of stiffind shear. Fracture: Typ	Fibre/Matrix Interfaction (cal, and mechanic) (glass fibre/polyeste) Title of the university volume and weight oven reinforcements bess and strengths bical fracture process	ce, Theories cal. Measure or, etc. Influe mit: Mecha fraction. Us s – length of unidire sses; effect	ement of i ince of interf nical Prope nidirectiona and orienta ectional con of transvers	n; absorption and nterface strength. Face on mechanical rties I continuous fibre, tion distributions. mposites; tension, se ply. Review of
pultrusion wetting, Character properties Unit – 3 Stiffness discontinu Mechanic compressi	n, centrifugal of Inter diffusion ization of syste of composite. Num and Strength: uous fibres, St cal Testing: I ion, flexure ar	casting and prepress. If n, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10 Geometrical aspects – hort fibre systems, we Determination of stiffi	Fibre/Matrix Interfaction (cal, and mechanic) (glass fibre/polyeste) Title of the university volume and weight oven reinforcements bess and strengths bical fracture process	ce, Theories cal. Measure or, etc. Influe mit: Mecha fraction. Us s – length of unidire sses; effect	ement of i ince of interf nical Prope nidirectiona and orienta ectional con of transvers	n; absorption and nterface strength. Face on mechanical rties I continuous fibre, tion distributions. mposites; tension, se ply. Review of
pultrusion wetting, Character properties Unit – 3 Stiffness discontinu Mechanic compressi fracture n matrix an	n, centrifugal of Inter diffusion ization of syste of composite. Num and Strength: lous fibres, St cal Testing: I ion, flexure ar nechanics method interface. Lo	casting and prepress. In n, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10 Geometrical aspects – hort fibre systems, we Determination of stiffin ad shear. Fracture: Typ hods and application to w and high-speed impa	Fibre/Matrix Interfaction (cal, and mechanic) (cal, and mechanic) (cal, and mechanic) (cal, and mechanic) (colume and weight) (colume and weight) (colume and strengths) (cal fracture process) (composites. Impact (ct test methods. Fatti	ce, Theories cal. Measure or, etc. Influe unit: Mecha fraction. U s – length of unidire sses; effect ct: Typical igue: Behavi	ement of i nice of interf nical Prope nidirectiona and orienta ectional con of transvers impact dam iour of notel	n; absorption and nterface strength. Face on mechanical rties continuous fibre, tion distributions. mposites; tension, se ply. Review of age; role of fibre, ned and unnotched
pultrusion wetting, Character properties Unit – 3 Stiffness discontinu Mechanic compress fracture n matrix and specimens	and Strength: Composite of composite. Num and Strength: Composite. Num and	casting and prepress. In n, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10 Geometrical aspects – hort fibre systems, we Determination of stiffin ad shear. Fracture: Typ hods and application to w and high-speed impa ng of composites. Fatig	Fibre/Matrix Interfaction (cal, and mechanic) (glass fibre/polyester Title of the university volume and weight oven reinforcements becal fracture processo composites. Impact (ct test methods. Fati- ue damage – Effect of	ce, Theories cal. Measure or, etc. Influe mit: Mecha fraction. U s – length of unidire sses; effect ct: Typical igue: Behavio of matrix and	ement of i ince of interf nical Prope nidirectiona and orienta ectional con of transvers impact dam iour of notel d fibre prope	n; absorption and nterface strength. Face on mechanical rties I continuous fibre, tion distributions. mposites; tension, se ply. Review of age; role of fibre, ned and unnotched erties. Implications
pultrusion wetting, Character properties Unit – 3 Stiffness discontinu Mechanic compress fracture n matrix and speciments for compo	a, centrifugal of Inter diffusion ization of syste of composite. Num and Strength: ous fibres, S al Testing: I ion, flexure ar nechanics met d interface. Lo s. Tension testi ponent design. E	casting and prepress. If n, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10 Geometrical aspects – hort fibre systems, we Determination of stiffind shear. Fracture: Typ hods and application to w and high-speed impa ng of composites. Fatig Environmental Effects: 1	Title of the u volume and weight oven reinforcements bical fracture proces composites. Impac ct test methods. Fati ue damage – Effect of Influence of moistur	ce, Theories cal. Measure r, etc. Influe mit: Mecha fraction. Us s – length of unidire sses; effect ct: Typical igue: Behavio of matrix and e and other	ement of i ince of interf nical Prope nidirectional and orienta ectional con of transvers impact dam iour of noted d fibre prope contaminan	n; absorption and nterface strength. Face on mechanical rties I continuous fibre, tion distributions. nposites; tension, se ply. Review of age; role of fibre, ned and unnotched erties. Implications ts on fibre, matrix,
pultrusion wetting, Character properties Unit – 3 Stiffness discontinu Mechanic compress fracture n matrix and speciments for compo	n, centrifugal of Inter diffusion ization of syste of composite. Num and Strength: lous fibres, St al Testing: I ion, flexure ar nechanics met d interface. Lo s. Tension testi onent design. E and effect on	casting and prepress. In n, electrostatic, chemi ems; carbon fibre/epoxy mber of lectures = 10 Geometrical aspects – hort fibre systems, we Determination of stiffin ad shear. Fracture: Typ hods and application to w and high-speed impa ng of composites. Fatig	Title of the u volume and weight oven reinforcements bical fracture proces composites. Impac ct test methods. Fati ue damage – Effect of Influence of moistur	ce, Theories cal. Measure r, etc. Influe mit: Mecha fraction. Us s – length of unidire sses; effect ct: Typical igue: Behavio of matrix and e and other	ement of i ince of interf nical Prope nidirectional and orienta ectional con of transvers impact dam iour of noted d fibre prope contaminan	n; absorption and nterface strength. Face on mechanical rties I continuous fibre, tion distributions. nposites; tension, se ply. Review of age; role of fibre, ned and unnotched erties. Implications ts on fibre, matrix,

Unit – 4	Number of lectures= 11Title of the unit: Joining Methods and Failure
	Theories
	lvantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths
	cedures. Design philosophy and procedures (systems approach). Simple design studies (pressure
	sion bar); factors of safety. Case studies for failure design process, materials selection,
	ng method. Economic aspects of using composites. Stress Analysis: Free edge stresses; typical
	s, significance of stacking sequence, significance of ply blocking, effect on failure modes,
	l evidence. Development of engineer's theory of bending for thin walled beams comprising several
	terials and analysis of the shear flow distribution. Buckling; strut buckling, buckling of especially
	plates, significance of bending-twisting coupling.
	cription of self-learning / E-learning component
The students v	will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures
delivered by s	subject experts of SGT University.
The link to the	e E-Learning portal.
http://sgtlms.o	org
T 1	
13. Books Red	rs; Patents in the respective field.
	commended
Text Book:	
	K.K. Chawla, (2007), Composite Materials, Springer-Verlag, New York.
Reference Bo	
	. Frank L. Matthews and Rees D. Rawlings (1999), Composite Materials: Engineering and Science,
	Voodhead Publishing.
	ling Hu (2012), Composites and Their Applications, in Tech Publisher
	avla Tesinova (2011) Advances in Composite Materials: Analysis of Natural and Man-Made
M	Iaterials, in Tech Publisher.

		Mechanical Engineering				
2. Cou			Т		Р	
Nan			•			
3. Cou		0	0		2	
Cod		~ ()				
• -	e of Course (use tick	Core (✓)	PE ()		OE ()	
mar	,				T '4	
5. Pre-		6. Frequency	Even	Odd (✔)	Either	Ever
-	nisite	(use tick	0		Sem	Sem
(if a		marks)	6		0	0
	al Number of Practical tures = 0	hours (assuming 14 week		rater) cal = 28		
		1 utorials = 0	Pracu	$cal = 2\delta$		
	f Syllabus	give students an insight ab	out the basic	of applied and	incoring moo	honios
	rning objectives:	give students an insight ab		s of applied eng	meeting mee	liames.
	o understand the conce	nts of forces				
		tions of static and dynamic	aguilibrium			
		principles of physics applie	•	ring Machanica		
-		properties of the different sl	•	ing wiechanics	•	
		properties of the different si	lapes.			
	rse Outcomes (Cos):		hader			
		work with forces acting on	a body.			
	*	nditions of a rigid body.				
	*	ent laws in real life probler		<u> </u>	1 1.1	
		center of gravity and mome	nt of inertia	of various surfa	ces and solids	3.
	t wise detailed content					
Sr. No.	Title					1
1	VI C C C	1 1 0 11 1 1	6.6		CO Co	vered
	Verification of triang	le law & parallelogram law	of forces		i)	vered
2	Verification of triang Verification of polyge		of forces			
2 3	Verification of polyge			lever apparatus	i) i), :	ii)
	Verification of polyge Verification of the pr	on law of forces	e bell crank	lever apparatus	i) i), :	ii) ii)
3	Verification of polyge Verification of the pr Verification of suppo	on law of forces	e bell crank	lever apparatus	i) i), i i), i	ii) ii) ii)
3	Verification of polyge Verification of the pr Verification of suppo Verification of condit	on law of forces inciple of moments using th rt reactions of a simply sup	e bell crank ported beam em of forces	lever apparatus	i) i), i i), i i), i	ii) ii) ii) ii)
3 4 5 6	Verification of polyge Verification of the pr Verification of suppo Verification of condit Verification of axial f	on law of forces inciple of moments using th rt reactions of a simply sup tion of equilibrium of a syst	e bell crank ported beam em of forces russ	lever apparatus	i) i), i i), i i), i i), i	ii) ii) ii) ii) ii)
3 4 5 6 7	Verification of polyge Verification of the prevention of support Verification of support Verification of condite Verification of axial for the prevention of	on law of forces inciple of moments using th rt reactions of a simply sup tion of equilibrium of a syst forces in the members of a t	e bell crank ported beam em of forces russ forces	lever apparatus	i) i), i i), i i), i i), i i), i	ii) ii) ii) ii) ii)
3 4 5	Verification of polyge Verification of the prevention of support Verification of support Verification of condite Verification of axial for Verification of equility Determination of coe	on law of forces inciple of moments using th rt reactions of a simply sup tion of equilibrium of a syst forces in the members of a t brium of three-dimensional	e bell crank ported beam em of forces russ forces	lever apparatus	i) i), i i), i i), i i), i i), i i), i	ii) ii) ii) ii) ii)

Department Electives-I Lab

mark) 5. Pre- requis (if any	and Air Conditioning Lab	L 0 Core () 6. Frequency	T 0 PE (✓)		P 2	
Code 4. Type o mark) 5. Pre- requis (if any	of Course (use tick) Engg. site Thermodynami	Core () 6. Frequency	-			
mark) 5. Pre- requis (if any) Engg. site Thermodynami	6. Frequency	PE (✓)		AF <i>c</i>	
requis (if any	site Thermodynami				OE ()	
		(use tick marks)	Even ()	(✔)	Either Sem ()	Every Sem
7. Total		marks)			0	0
	Number of Lectures, Tu	utorials, Practical (a	ssuming 14	weeks of one s	semester)	
Lectur	res = 0	Tutorials = 0	Practica	l = 28		
9. Learn i) ii) iii) iii) iv)	er high-energy reservoir. ing objectives: To understand the princi To calculate the cooli conditioning. To learn the principles o To develop the knowled Refrigeration and Air-co	ing load for differ f psychrometry. lge of selecting the r	ent applicat	ions of Refri	0	
10. Course	e Outcomes (COs):					
ii) iii)	Possess the knowledge of Design and implement re Apply the knowledge of calculations. Possess the knowledge of	efrigeration and air coordinate of psychrometry in	onditioning s calculating	ystems using s cooling load	tandards. and heat	ing load
	vise detailed content					-
Sr. No.	Title				COs Co	vered
	To study the vapour com	Ũ	n System and	l determine its	i), i	v)
	C.O.P. and draw P-H and	_			:)	
2 7	To Study the Mechanical To study the Air and Wat	1 1			i) i)	

4	To study the cut- sectional models of Reciprocating and Rotary	iv)
	Refrigerant compressor.	
5	To study the various controls used in Refrigerating & Air Conditioning	ii)
	systems.	
6	To study the Ice- plant, its working cycle and determine its C.O.P and	i), ii), iv)
	capacity.	
7	To study the humidification, heating, cooling and dehumidification	iii)
	processes and plot them on Psychrometric charts.	
8	To determine the By-pass factor of Heating & Cooling coils and plot them	iii)
	on Psychrometric charts on different inlet conditions.	
9	To determine sensible heat factor of Air on re-circulated air-conditioning	iii)
	set up.	
10	To study the chilling plant and its working cycle.	iv)

1.	Name of the	e Department- Mecl	hanical Engineering	5				
2.	Course	Advanced	L T			Р		
	Name	Machining						
		Processes Lab						
3.	Course Code		0		0		4	
4.	Type of Cou mark)	urse (use tick	Core ()	PE (✔)	OE ()	EAS ()	BSC ()	
5.	Pre-		6. Frequency	Even	Odd	Either	Every	
	requisite		(use tick	0	0	Sem	Sem	
	(if any)		marks)			0	0	
7.	Total Numb	er of Lectures. Tut	orials. Practical (as	uming 14 we	eks of one s	emester)	1	

Lectures = 00Tutorials = 0

Practical = 56

8. Course Description

Today's stringent design requirements and difficult-to-machine materials such as tough super alloys, ceramics, and composites, have made traditional machining processes costly and obsolete. As a result, manufacturers and machine design engineers are turning to advance machining processes. These machining processes utilizes electrical, chemical and optimal sources of energy to machine the given job. Going through this subject student will get insight of various advanced machining processes and their system components, process variables and industrial applications. This is a perfect course for anyone designing, researching or converting to a more advance machining process.

9. Learning objectives:

- i) To teach the principles of Mechanical Advanced Machining Processes.
- ii) To understand the concept of EDM.
- iii) To understand the concept of IBM, EBM, PAM etc.
- iv) To understand the concept of advance finishing process

10. Course Outcomes (COs): The curriculum of the Department is designed to satisfy the diverse needs of students.

- i) Acquire Knowledge of manufacturing process for advanced materials and critical finishing.
- ii) Acquire Knowledge of concept of EDM.
- iii) Acquire Knowledge of concept of IBM, EBM, PAM etc.
- iv) Acquire Knowledge of advance finishing process

11. Lab	Content	
Sr. No.	Title	COs covered
1	To study the MRR of USM	i)
2	To study the MRR of Abrasive jet machining	i)
3	To study the MRR of water jet machining	i)
4	To study the MRR of EDM	ii)
5	To study the Analysis of R-C Circuits in EDM	ii)
6	To study the MRR of Wire EDM	ii)
7	To study the MRR of Laser, and Electron Beam Machining	iii)
8	To study the MRR of Ion Beam Machining	iii)

9	To study the MRR of Plasma Arc Machining	iii)
10	To study the MRR of MAF	iv)
11	To study the MRR of AFM	iv)
12	To study the MRR of Chemo mechanical polishing	iv)

2. Cot	irse Advan	nent- Mechar	<u>L</u>		Т		Р
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2 0		eering Lab	0		0		•
3. Cou			0		0		2
Coc							
• -	e of Course (use	tick	Core ()	PE (✓)	OE ()	
mai	,						
5. Pre		Engines	6. Frequency	Even	Odd (✔)	Either	Ever
	uisite		(use tick	0		Sem	Sem
(if a			marks)			0	0
7. Tot	al Number of Le	ctures, Tutor	rials, Practical (assu	uming 14 we	eks of one seme	ester)	
Lec	tures = 0		Tutorials = 0	Practi	cal = 28		
8. Cou	rse Description						
utomol	oile engineering is	the one of th	e streams of mechar	nical engineer	ing. It deals with	h the variou	is types of
	• •		ission systems and i	Ũ	U U		• •
			ssengers, goods, etc				
	-	-	ses or sometimes the	-	• •		
-		-	the cylinder at high	-			-
	• •		ternal combustion e	-	-	initio stori ini	
	rning objectives:		contra contraction c	inglifies verifier	es only.		
			f atur da nata in tha atm	ations of right	-1hid -		
		-	f students in the stru	icture of veni	cie chassis and e	engines.	
-	Fo introduce stude		•	_			
	Fo introduce stude	ents to steering	a anomanaian healti				
<u></u>) -				-	nission systems.		
-	Fo introduce stude	ents to engine	auxiliary systems lil	-	•	-conditionii	ng, and als
t	Fo introduce stude he importance of	ents to engine alternate fuels	auxiliary systems lil	-	•	-conditioni	ng, and als
t	Fo introduce stude	ents to engine alternate fuels	auxiliary systems lil	-	•	-conditioni	ng, and als
t 10. Cou	To introduce stude he importance of irse Outcomes (C	ents to engine alternate fuels COs):	auxiliary systems lil	ke heating, ve	ntilation and air	-conditionin	ng, and als
t 10. Cou i) l	Fo introduce stude he importance of Irse Outcomes (C Develop chassis a	ents to engine alternate fuels COs): nd identify su	auxiliary systems lil s.	ferent applica	ntilation and air		ng, and als
t 10. Cou i) l ii) <i>1</i>	Fo introduce stude he importance of irse Outcomes (C Develop chassis a: Able to select a su	ents to engine alternate fuels COs): nd identify su itable conven	auxiliary systems lil s. itable engine for dif tional and automatic	ferent applicate transmission	ntilation and air tions.		ng, and als
t 10. Cou i) 1 ii) 2 iii) 1	Fo introduce stude he importance of urse Outcomes (C Develop chassis at Able to select a su Formulate Steering	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C	auxiliary systems lil s. itable engine for dif tional and automatic control, Braking and	ferent applica transmission Suspension S	ntilation and air tions. n system for the Systems.		ng, and als
t 10. Cou i) 1 ii) 2 iii) 1 iv) 1	Fo introduce stude he importance of irse Outcomes (C Develop chassis as Able to select a su Formulate Steering dentify the usage	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C	auxiliary systems lil s. itable engine for dif tional and automatic	ferent applica transmission Suspension S	ntilation and air tions. n system for the Systems.		ng, and als
t 10. Cou i) 1 ii) 4 iii) 1 iv) 1 1. Lab	To introduce stude he importance of urse Outcomes (C Develop chassis at Able to select a su Formulate Steering dentify the usage Content	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C	auxiliary systems lil s. itable engine for dif tional and automatic control, Braking and	ferent applica transmission Suspension S	ntilation and air tions. n system for the Systems.	Vehicle.	
t 10. Cou i) 1 ii) 2 iii) 1 iv) 1 <u>1. Lab</u> Sr. No.	Fo introduce stude he importance of irse Outcomes (C Develop chassis a Able to select a su Formulate Steering dentify the usage Content Title	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical	auxiliary systems lil s. itable engine for dif tional and automatic control, Braking and vehicles / Hybrid ve	ferent applica transmission Suspension S hicles and po	ntilation and air tions. a system for the Systems. wer plants.	Vehicle.	covered
t 10. Cou i) 1 ii) 4 iii) 1 iv) 1 1. Lab	To introduce stude he importance of urse Outcomes (C Develop chassis as Able to select a su Formulate Steering dentify the usage Content Title To study and p	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report	auxiliary systems lil s. itable engine for dif tional and automatic control, Braking and vehicles / Hybrid ve	ferent applica transmission Suspension S hicles and po	ntilation and air tions. a system for the Systems. wer plants. king principles	Vehicle.	
t 10. Cou i) 1 ii) 2 iii) 1 iv) 1 <u>1. Lab</u> fr. No.	Fo introduce stude he importance of urse Outcomes (C Develop chassis at Able to select a su Formulate Steering dentify the usage Content Title To study and p operation of the	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report e following A	auxiliary systems lil s. itable engine for difficient of the system of t	ferent applica transmission Suspension S hicles and po	ntilation and air tions. a system for the Systems. wer plants. king principles	Vehicle.	covered
t 10. Cou i) 1 ii) 4 iii) 1 iv) 1 1. Lab 5r. No. 1	To introduce stude he importance of irse Outcomes (C Develop chassis as Able to select a su Formulate Steering dentify the usage Content Title To study and p operation of the (a) Multi-cylin	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report e following A ider : Diesel a	auxiliary systems lil s. itable engine for difficient tional and automatic control, Braking and vehicles / Hybrid ve on the constructiona utomotive Engine S nd Petrol Engines.	ferent applica transmission Suspension S hicles and po ll details, wor ystems & Sul	ntilation and air tions. a system for the Systems. wer plants. king principles o Systems.	Vehicle. COs and	covered i)
t 10. Cou i) 1 ii) 2 iii) 1 iv) 1 <u>1. Lab</u> fr. No.	To introduce stude he importance of irse Outcomes (C Develop chassis at Able to select a su Formulate Steering dentify the usage Content Title To study and p operation of the (a) Multi-cylin To study and p	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report e following A ider : Diesel a repare report	auxiliary systems lil s. itable engine for difficient tional and automatic control, Braking and vehicles / Hybrid ve on the constructiona utomotive Engine S nd Petrol Engines. on the constructiona	ferent applica transmission Suspension S hicles and po l details, wor ystems & Sul	ntilation and air tions. a system for the Systems. wer plants. king principles o Systems.	Vehicle. COs and and	covered
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t 10. Cou i) 1 ii) 4 iii) 1 iv) 1 1. Lab Sr. No. 1	Fo introduce stude he importance of irse Outcomes (C Develop chassis at Able to select a su Formulate Steering dentify the usage Content Title To study and p operation of the (a) Multi-cylin To study and p operation of the Carburetors (b) Systems.	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report e following A ider : Diesel a repare report e following Fuel I	auxiliary systems lil s. itable engine for difficient and automatic control, Braking and vehicles / Hybrid ve on the constructiona utomotive Engine S nd Petrol Engines. on the constructiona uels supply systems:	ferent applica transmission Suspension S hicles and po l details, wor ystems & Sul l details, wor	ntilation and air ntilations. n system for the Systems. wer plants. king principles o Systems. king principles a (lel Injection	Vehicle. COs and and a)	covered i)
t 10. Cou i) 1 ii) 4 iii) 1 iv) 1 1. Lab 5r. No. 1 2	To introduce stude he importance of irse Outcomes (C Develop chassis at Able to select a su Formulate Steering dentify the usage Content Title To study and p operation of the (a) Multi-cylin To study and p operation of the Carburetors (b) Systems. To study and p	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report e following A ider : Diesel a repare report e following Fu Diesel Fuel I	auxiliary systems lil s. itable engine for difficient and automatic control, Braking and vehicles / Hybrid ve on the constructiona utomotive Engine S nd Petrol Engines. on the constructiona uels supply systems: injection Systems (constructional)	ferent applica ferent applica transmission Suspension S hicles and po li details, wor ystems & Sul details, wor) Gasoline Fu	ntilation and air ntilation and air tions. a system for the Systems. wer plants. king principles b Systems. king principles a (lel Injection king principles	Vehicle. COs and and a)	covered i) i)
t 10. Cou i) 1 ii) 4 iii) 1 iv) 1 1. Lab Sr. No. 1 2	Fo introduce stude he importance of irse Outcomes (C Develop chassis at Able to select a su Formulate Steering dentify the usage Content Title To study and p operation of the (a) Multi-cylin To study and p operation of the Carburetors (b) Systems. To study and p operation of the	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report e following A ider : Diesel a repare report e following Fu Diesel Fuel I repare report e following A	auxiliary systems lil s. itable engine for difficient of the construction control, Braking and vehicles / Hybrid ve on the construction utomotive Engine S nd Petrol Engines. on the construction uels supply systems: injection Systems (construction	ferent applica transmission Suspension S hicles and po li details, wor ystems & Sul details, wor) Gasoline Fu li details, wor sion systems	ntilation and air ntilation and air ntions. n system for the Systems. wer plants. king principles o Systems. king principles a (tel Injection king principles	Vehicle. COs and and a)	covered i) i)
t 10. Cou i) 1 ii) 4 iii) 1 iv) 1 11. Lab Sr. No. 1 2	To introduce stude he importance of irse Outcomes (C Develop chassis at Able to select a su Formulate Steering dentify the usage Content Title To study and p operation of the (a) Multi-cylin To study and p operation of the Carburetors (b) Systems. To study and p operation of the (a) Synchromes	ents to engine alternate fuels COs): nd identify su itable conven g, Pollution C of Electrical repare report e following A der : Diesel a repare report e following Fu Diesel Fuel I repare report e following A sh – Four spec	auxiliary systems lil s. itable engine for difficient tional and automatic control, Braking and vehicles / Hybrid ve on the constructiona utomotive Engine S nd Petrol Engines. on the constructiona uels supply systems: injection Systems (c on the constructiona utomotive Transmis	te heating, ve ferent applica transmission Suspension S hicles and po li details, wor ystems & Sul details, wor) Gasoline Fu li details, wor sion systems axle with Dua	ntilation and air tions. a system for the Systems. wer plants. king principles b Systems. king principles a (tel Injection king principles al Speed Range.	Vehicle. COs and and and and	covered i) i)

	(a) Rear Wheel Drive Line. (b) Front Wheel Drive Line. (c) Differentials, Drive	
	Axles and Four Wheel Drive Line.	
5	To study and prepare report on the constructional details, working principles and	iii)
	operation of the following Automotive Steering Systems.	
	(a) Manual Steering Systems, e.g. Pitman -arm steering, Rack & Pinion steering.	
	(b) Power steering Systems, e.g. Rack and Pinion Power Steering System. (c)	
	Steering Wheels and Columns	
6	To study and prepare report on the constructional details, working principles and	iii)
	operation of Automotive Emission / Pollution control systems.	
7	To study and prepare report on the constructional details, working principles and	iii)
	operation of the following Automotive Tyres & wheels.	
	(a) Various Types of Bias & Radial Tyres. (b) Various Types of wheels.	
8	To study and prepare report on the constructional details, working principles and	iii)
	operation of the Automotive Brake systems.	
	(a) Hydraulic & Pneumatic Brake systems. (b) Drum Brake System. (c) Disk	
	Brake System. (d) Antilock Brake System. (e) System Packing & Other Brakes	
9	To study and prepare report on the constructional details, working principles and	iv)
	operation of the cooling system.	
	(a) Engine cooling & Lubricating Systems.	
10	To study and prepare report on the constructional details, working principles and	iii)
	operation of effect on health of emissions from diesel engine & petrol engine	

2. Course N	lame	Industrial Engineering Lab]			Τ]	P
3. Course C	Code		()		0 PE (✓)		2
4. Type of (Course	(use tick mark)	Core ()	EAS ()	PE (✓			
5. Pre-requ (if any)	isite		6. Frequency marks)	v (use tick	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Nu	mber o	of Lectures, Tutorials, 1	Practical (assur	ning 14 week	s of one se	mester)		
Lectures = 0			Tutorials = 0		Practi	cal = 28		
8. Course D	Descrip	tion						
i) Learn ii) Learn iii) Learn	structur basic basic basic	tives: re, operation and applica concept of productivities concept of cost analysis concept of Inventory con concept of Industrial and	s in industrial ma for a manufactu ntrol and its appl	anufacturing. ring system. ication.	trial produ	ction and	Managen	nent.
i) Definii) Perforiii) Under	e and i rm full rstand	nes (COs): After the com measure various producti cost analysis for a manu the concept of Inventory features of Industrial an	vities in industr facturing syster control and its a	ial manufactu n. application.		e able to		
11. Lab Con	tent							
Sr. No.	ſ	Title					Cos cov	ered
1	Г	o Study the THERBLIG	S work measure	ement using c	ase study.			i)
2	Г	To Study the time study I	PMTS using case	e study.				i)
3	Г	o study the factors effec	ting productivity	<i>.</i>				i)
4	Г	o Study the Manufactur	ing Cost Analys	is using case	study.			ii)
5	Г	o Study the Master prod	luction schedule	system.				ii)
6	Г	o study the Gantt chart i	n manufacturing	g using case s	tudy.			ii)
7	Г	To study the P, Q, S's Sy	stems					iii)
8	Г	To study the ABC and FS	SN system.					iii)
9	Г	To study the VED and the	ree-dimensional	system.				iii)
10	Г	To study the role of 3 S in	n the system.					iv)

2.	Course Name	Product Design for Manufacturing Lab	L			T		2
3.	Course Code			0		0	2 OE ()	
4.	Type of Course	e (use tick mark)	Core ()	EAS ()	PE (✓)		
5.	Pre-requisite (if any)		6. Frequer marks)	ncy (use tick	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tutorials, 1	Practical (ass	uming 14 week	s of one se	mester)		
Le	ctures = 0		Tutorials =	0	Practi	cal = 28		
8.	Course Descrip	otion						

Product design for manufacturing is the general engineering art of designing products in such a way that they are easy to manufacture. This design practice not only focuses on the design aspect of a part but also on the product ability. In simple language it means relative ease to manufacture a product, part or assembly. DFM describes the process of designing or engineering a product in order to facilitate the manufacturing process in order to reduce its manufacturing costs. This course will impart knowledge of various methods and approaches used in design of manufacturing. Moreover, students will get familiar to DFMA software through case studies. In the end of course, student will be able to utilize the knowledge gained through coursework for the development of new product.

9. Learning objectives:

- i) To expose with basics of product design and manufacturing.
- ii) To introduce principles and evaluation methods of various aspects of designing components.
- iii) To teach about the manufacturability requirements

iv) To expose with basics of assembly processes and DFMA software for case studies.

10. Course Outcomes (COs):

- i) Apply customer-oriented, manufacturing and life cycle sensitive approach to product design and development with product design principles and structured design methodologies.
- ii) Possess methods and approaches for principles and evaluation methods of various aspects of designing components
- iii) Develop a manufacturability of new product as per the requirement.
- iv) Demonstrate the knowledge of DFMA software for case studies

11. Lab Content

Sr. No.	Title	COs covered
1	To Study the Asimow's Model.	i)
2	To Study the Product design practice in Industry.	i)
3	To study evaluation methods of various aspects of Design for sheet metal working.	ii)

4	To Study the evaluation methods of various aspects of Design for injection molding.	ii)
5	To Study the Casting design Manufacturability requirements.	iii)
6	To study the Forging design Manufacturability requirements	iii)
7	To study the Pressed component design Manufacturability requirements.	iii)
8	To study the techniques for new product development processes	iv)
9	To study the Dewhurst Method- case studies using DFMA software	iv)
10	To study the Boothroyd method- case studies using DFMA software	iv)

2.	Course Name Advance Materials		e Name Advance L T Materials Lab			Р		
3.	B. Course Code		0	0		2		
4.	Type of Co	urse (uso	e tick mark)	Core ()	PE (✓)		OE ()	
	Pre-requisit any)	te (if		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Numb	oer of Lo	ectures, Tutorials,	Practical (assuming 14 w	eks of one	semester	·)	
Lec	tures = 0			Tutorials = 0	Practica	al = 28		
8.	Course Des	cription						
This	subject cov	ers pract	ical knowledge abo	ut the advance materials, the	eir develor	ment Ch	aracterizat	ion and
	5		U	e materials and nano mater	-	-		
	ngth.				und und		Propor	ines und
		• .•			. 1 11 1	11 -		
	_	-	-	ion of the course, the stude	nt shall be a	able to		
	· •	-	bractical knowledge					
		-	•	dying characterization pro	cess.			
	\mathbf{m}) $\mathbf{D}\mathbf{e}\mathbf{v}$			advanced meterials				
	iv) To g	give the	understanding of ma	advanced materials. Iterial characterisation prop Inpletion of the course, the		l be able 1	to	
10.	iv)To gCourse Outi)Undii)Seleiii)Und	give the model comes (erstand a ct consti erstand o	understanding of ma COs): After the con advance material an ituent materials glass engineering mechan	terial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma	student shal fibres and r acro and mi	resins. cro mecha	nics of co	-
10.	iv) To g Course Out i) Und ii) Sele iii) Und iii) Dev	comes (erstand a ct consti erstand a elop and	understanding of ma COs): After the con advance material an ituent materials glass engineering mechan	nterial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic	student shal fibres and r acro and mi	resins. cro mecha	nics of co	-
10. 11.	iv)To gCourseOuti)Undii)Seleiii)Undiv)DevLabConten	comes (comes (erstand a ct consti erstand a elop and t	understanding of ma COs): After the con advance material an ituent materials glass engineering mechan	terial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma	student shal fibres and r acro and mi	resins. cro mecha	nnics of con omposites	•
10. 11. Sr. 1	iv)To gCourse Outi)Undii)Seleiii)Undiv)DevLab ContenNo.Title	give the r comes (erstand a ct consti erstand a elop and t	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta	terial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma l- matrix, ceramic -matrix	student shal fibres and r acro and mi	resins. cro mecha	nnics of con omposites COs co	vered
10. 11. Sr. 1	iv)To gCourse Outi)Undii)Seleiii)Undiv)DevLab ContenNo.Title	give the r comes (erstand a ct consti erstand a elop and t	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta	terial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma	student shal fibres and r acro and mi	resins. cro mecha	nnics of con omposites COs co	•
10. 11. Sr. 1	iv)To gCourseOuti)Undii)Seleiii)Undiv)DevLabContentNo.Title1To st	give the tree comes (for erstand a ct constituent of the constituent o	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta	terial characterisation prop ppletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma l- matrix, ceramic -matrix rties and characteristics.	student shal fibres and r acro and mi	resins. cro mecha	nics of composites	vered
10. 11. Sr.]	iv)To gCourse Outi)Undii)Seleiii)Undiv)DevLab ContenNo.Title1To st2To st	give the r comes (erstand a ct consti erstand a elop and t udy adv. udy diffa	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta ance Material prope erent Crystallograph	terial characterisation prop ppletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma l- matrix, ceramic -matrix rties and characteristics.	fibres and r fiores and mi- and carbon-	resins. cro mecha	unics of contract	vered
10. 11. Sr. 1	iv)To gCourseOuti)Undii)Seleiii)Undiv)DevLabContentNo.Title1To st2To st3Synth	restand a comes (f erstand a ct consti erstand a elop and t udy adva udy diffe nesis of 1	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta ance Material prope erent Crystallograph Ni-SiO2 nanocompo	terial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma 1- matrix, ceramic -matrix rties and characteristics.	fibres and r fiores and mi- and carbon-	resins. cro mecha	COs co	vered i) ii)
10. 11. Sr. 1	iv)To gCourse Outi)Undii)Seleiii)Undiii)Undiv)DevLab ContenNo.Title1To st2To st3Synth4Char	give the n comes (f erstand a ct consti erstand a elop and at udy adva udy diffe nesis of 1 acterizat	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta ance Material prope erent Crystallograph Ni-SiO2 nanocomposition of nano-composition	terial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma l- matrix, ceramic -matrix rties and characteristics. nic method.	fibres and r facro and mi- and carbon-	resins. cro mecha	COs co i i i i)	vered i) ii) iv)
10. 111. Sr.]	iv)To gCourseOuti)Undii)Seleiii)Undiv)DevLabContenNo.Title1To st2To st3Syntl4Char5Meas	rive the n comes (f erstand a ct consti erstand a elop and t udy adva udy diffe nesis of 1 acterizat	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta ance Material prope erent Crystallograph Ni-SiO2 nanocompos ion of nano-compose t of magnetic proper	terial characterisation prop ppletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma l- matrix, ceramic -matrix rties and characteristics. nic method. osites by Sol-Gel technique	student shal fibres and r acro and mi- and carbon-	resins. cro mecha	COs co i i i i i i) i),	vered i) ii) iii) iv) , ii)
10. 11. Sr. 1	iv)To gCourse Outi)Undii)Seleiii)Undiii)DevLab ContenNo.Title1To st2To st3Synth4Char5Meas6Char	give the transformes (for each of the comes (for each of the comes) of the company of the compan	anderstanding of ma COs): After the con advance material an ituent materials glass engineering mechan processing of meta ance Material prope erent Crystallograph Ni-SiO2 nanocompos ion of nano-compos t of magnetic proper ion of ZnO Nanostr	terial characterisation prop npletion of the course, the d their properties. s, carbon, aramid, ceramic ics, analysis and design, ma l- matrix, ceramic -matrix rties and characteristics. nic method. osites by Sol-Gel technique sites by XRD analysis.	student shal fibres and r acro and mi and carbon-	resins. cro mecha	COs co i i i i) i), i), i),	vered i) ii) iii) iv) , ii) , iii)

9	Electrical property measurement of dielectric materials (BaTiO 3)using P-E loop technique.	iii)
10	Characterization of materials by SAXS analysis.	i), ii)

Department Electives-II Lab

	G ()		m	I		
2. Cours		L	Т		Р	
Name	Generation Lab					
3. Cours	se	0	0		2	
Code						
4. Type	of Course (use tick	Core ()	PE (✓)		OE ()	
mark			I E (•)		OE ()	
5. Pre-	Engineering	6. Frequency	Even	Odd	Either	Every
requi	8 8	(use tick	0	(✔)	Sem	Sem
(if an	-	marks)	×		0	0
7. Total	Number of Lectures, Tuto	orials, Practical (assu	ming 14 week	s of one sem	ester)	
Lectu	res = 0	Tutorials = 0	Practica	l = 28		
8. Brief	Syllabus ach students about the worl	king of various power	generation w	nite and stop	m ovelag To	introduc
	its to steam generators, con	v	•		•	
	potentialities of the count	-				
-	s used in power generation.	ry. To enable students	, understand	Tunetioning	or ooners, tu	ionies an
	ning objectives:		c 1 .			
	course will describe the fur					
	cuss the fundamental princip	-	mbustion			
	understanding of various th	ermai power plants.				
ir)The	understanding of various of					
	understanding of various ga					
10. Cours	se Outcomes (COs):	as power plants				
10. Cours i) De	se Outcomes (COs): scribe sources of energy and	as power plants d types of power plants				
10. Cours i) De ii) An	se Outcomes (COs): escribe sources of energy and alyze the performance of di	as power plants d types of power plants esel powered thermal p	ower plant.	nd condenser		
 10. Cours i) De ii) An iii) De 	se Outcomes (COs): escribe sources of energy and alyze the performance of di escribe basic working princip	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo	oower plant. ling towers ar			s of powe
 10. Cours i) De ii) An iii) De iv) Est 	se Outcomes (COs): escribe sources of energy and alyze the performance of di escribe basic working princip timate different efficiencies	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo	oower plant. ling towers ar			s of powe
 10. Course i) Dee ii) Ann iii) Dee iv) Esse 	se Outcomes (COs): escribe sources of energy and alyze the performance of di escribe basic working princip timate different efficiencies neration.	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo	oower plant. ling towers ar			s of powe
10. Course i) Dee ii) Ann iii) Dee iii) Dee iv) Esse gen	se Outcomes (COs): escribe sources of energy and alyze the performance of di escribe basic working princip timate different efficiencies neration.	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo	oower plant. ling towers ar			
10. Cours i) De ii) An iii) De iv) Est gen 11. Lab (se Outcomes (COs): escribe sources of energy and alyze the performance of di escribe basic working princip timate different efficiencies neration.	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe	oower plant. ling towers ar		ze economic	vered
10. Cours i) De ii) An iii) De iv) Est ger 11. Lab (Sr. No.	se Outcomes (COs): escribe sources of energy and alyze the performance of di escribe basic working princip timate different efficiencies neration. Content Title	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe	bower plant. ling towers ar r plant system	ns and Analy	ze economic	vered
10. Cours i) De ii) An iii) De iv) Est gen 11. Lab (Sr. No. 1	se Outcomes (COs): escribe sources of energy and alyze the performance of di escribe basic working princip timate different efficiencies neration. Content Title To study of modern ste	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe eam power plant. rious Types of Fuel &	oower plant. ling towers ar r plant systen Ash Handling	s and Analy Systems	ze economic CO Co i),	vered
10. Cours i) De ii) An iii) De iv) Ess gen 11. Lab (Sr. No. 1 2	se Outcomes (COs): scribe sources of energy and alyze the performance of di scribe basic working princip timate different efficiencies neration. Content Title To study of modern ste To Study about the Va To study about differen burners.	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe eam power plant. rious Types of Fuel & nt types of dust collected	oower plant. ling towers ar r plant systen Ash Handling	s and Analy Systems	CO Co i), ii) ii)	vered ii)
10. Cours i) De ii) An iii) De iv) Est gen 11. Lab (Sr. No. 1 2 3 4	se Outcomes (COs): escribe sources of energy and halyze the performance of di escribe basic working princip timate different efficiencies meration. Content Title To study of modern ster To Study about the Va To study about different burners. To study about nuclear	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe eam power plant. rious Types of Fuel & nt types of dust collected r power plant.	oower plant. ling towers ar r plant systen Ash Handling	s and Analy Systems	ze economic CO Co i), ii) ii) ii)	vered ii) ii)
10. Cours i) De ii) An iii) De iv) Ess gen 11. Lab C Sr. No. 1 2 3 4 5	se Outcomes (COs): scribe sources of energy and alyze the performance of di scribe basic working princip timate different efficiencies neration. Content Title To study of modern ste To Study about the Va To study about different burners. To study about nuclear To study of different ty	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe eam power plant. rious Types of Fuel & nt types of dust collector r power plant. ypes of steam turbines.	bower plant. ling towers ar r plant system Ash Handling ors and pulver	s and Analy Systems	ze economic CO Co i), ii) ii) ii) i), i),	vered ii) ii) ii)
10. Cours i) De ii) An iii) De iv) Est gen 11. Lab (Sr. No. 1 2 3 4 5 6	se Outcomes (COs): scribe sources of energy and alyze the performance of di scribe basic working princip timate different efficiencies neration. Content Title To study of modern ster To Study about the Va To study about different burners. To study about nuclear To study of different ty To study about different ty To study about different ty	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe eam power plant. rious Types of Fuel & nt types of dust collected r power plant. ypes of steam turbines. nt types of condensers	oower plant. ling towers ar r plant system Ash Handling ors and pulver and cooling to	s and Analy Systems	ze economic CO Co i), ii) ii) ii) ii), i), iii	vered ii) ii) ii))
10. Cours i) De ii) An iii) De iii) De iv) Es gen 11. Lab C Sr. No. 1 2 3 4 5 6 7	se Outcomes (COs): scribe sources of energy and alyze the performance of di scribe basic working princip timate different efficiencies neration. Content Title To study of modern ste To study about the Va To study about different burners. To study about nuclear To study of different ty To study about different To study about different	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe eam power plant. rious Types of Fuel & nt types of dust collected r power plant. ypes of steam turbines. nt types of condensers nics of power generation	oower plant. ling towers ar r plant system Ash Handling ors and pulver and cooling to	s and Analy Systems	ze economic CO Co i), ii) ii) ii) ii) ii) ii) ii)	vered ii) ii) ii))
10. Cours i) De ii) An iii) De iv) Est gen 11. Lab (Sr. No. 1 2 3 4 5 6	se Outcomes (COs): scribe sources of energy and alyze the performance of di scribe basic working princip timate different efficiencies neration. Content Title To study of modern ster To Study about the Va To study about different burners. To study about nuclear To study of different ty To study about different ty To study about different ty	as power plants d types of power plants esel powered thermal p ples of gas turbine, coo associated with powe eam power plant. rious Types of Fuel & nt types of dust collected r power plant. ypes of steam turbines. nt types of condensers nics of power generation plant.	oower plant. ling towers ar r plant system Ash Handling ors and pulver and cooling to on systems.	s and Analy Systems	ze economic CO Co i), ii) ii) ii) ii) ii) ii) ii)	vered ii) ii) ii) j

10	Testing of diesel fired water tube boiler-based steam power plant.	ii)
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			nanical Engineering	-			
2. Cour		Production	L	Т			Р
Nam	e	Planning and					
		Control Lab					
3. Cour	se		0		0		2
Code						2	
4. Type	e of Cou	rse (use tick	Core ()	PE	OE	EAS ()	BSC ()
marl	x)			(✔)	0		
5. Pre-			6. Frequency	Even	Odd	Either	Every
requ	isite		(use tick	0	(✔)	Sem	Sem
(if ar	ny)		marks)	V		0	0
					1 6	-	· ·
	<u> Numbe</u> tures = (,	orials, Practical (assu Tutorials = 0		eks of one se cal = 56	emester)	
Lee	ui cs – (1 utor rais = 0	Traction	.ai – 50		
	rse Desc						
	•	• •	nning sets the objectiv	e	•		
	•		ol is the integral part			•	
		-	assessment can be m				
advance.	Plannin	g involves setting	up to such standard.	The controll	ing is made	e by comparin	g the actua
performa	nce with	these present stand	ard and deviations are	e ascertained a	nd analyzed	•	
9. Lear	ning oh	iectives:					
		ind suggest confect	type of production pla	nning techniq	ue.		
	Analyze	the concepts of proc	luction planning.		•		
iii) (Analyze Control a	the concepts of proc and implement PPC	luction planning. methods in crucial are	eas of the indu	istry.		
iii) (iv) I	Analyze Control a mpleme	the concepts of proc and implement PPC nt the knowledge of	luction planning. methods in crucial are ERP systems and sho	eas of the indu op floor sched	istry. uling.	6 (1 1)	1.6
iii) (iv) 1 10. Cour	Analyze Control a mplemer rse Outo	the concepts of proc and implement PPC nt the knowledge of	luction planning. methods in crucial are	eas of the indu op floor sched	istry. uling.	sfy the diverse	needs of
iii) (iv) I 10. Cour stude	Analyze Control a <u>mpleme</u> rse Outco ents.	the concepts of proc and implement PPC nt the knowledge of omes (COs): The c	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa	eas of the indu op floor sched artment is desi	istry. uling.	sfy the diverse	needs of
iii) (iv) I 10. Coun stude i) A	Analyze Control a <u>mpleme</u> rse Outc ents. Acquire l	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning	eas of the indu op floor sched artment is desi	istry. uling.	sfy the diverse	needs of
iii) (iv) I 10. Coun stude i) A ii) A	Analyze Control a mplemen rse Outc ents. Acquire I Acquire I	the concepts of proc and implement PPC nt the knowledge of omes (COs): The c Knowledge of type of Knowledge of produ	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning.	eas of the indu op floor sched artment is desi g technique	ustry. uling. gned to satis		
iii) (iv) <u>I</u> 10. Cour stude i) <i>A</i> ii) <i>A</i> iii) <i>A</i>	Analyze Control a mplement rse Outco ents. Acquire I Acquire I Acquire I	the concepts of prod and implement PPC nt the knowledge of omes (COs): The c Knowledge of type of Knowledge of production	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO	eas of the indu op floor sched urtment is desi g technique C methods in o	ustry. uling. gned to satis crucial areas	of the industr	у.
iii) (iv) 1 10. Cou stude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iii) <i>A</i>	Analyze Control a mpleme rse Outco ents. Acquire I Acquire I Acquire I	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of Knowledge of production Knowledge of Contri- Knowledge of Imple	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning.	eas of the indu op floor sched urtment is desi g technique C methods in o	ustry. uling. gned to satis crucial areas	of the industr	у.
iii) (iv) 1 10. Counstude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> 11. Lab	Analyze Control a mpleme rse Outco ents. Acquire I Acquire I Acquire I	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of Knowledge of production Knowledge of Contri- Knowledge of Imple	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO	eas of the indu op floor sched urtment is desi g technique C methods in o	ustry. uling. gned to satis crucial areas	of the industr floor schedulir	у.
iii) (iv) 1 10. Counstude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> 11. Lab	Analyze Control a mpleme rse Outconts. Acquire I Acquire I Acquire I Content Title	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of Knowledge of produ Knowledge of Contr Knowledge of Imple	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO	eas of the indu op floor sched artment is desi g technique C methods in o of ERP systen	ustry. uling. gned to satis crucial areas	of the industr floor schedulir	y. 1g.
iii) (iv) 1 10. Cou stude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> 11. Lab Sr. No.	Analyze Control a mpleme rse Outconts. Acquire I Acquire I Acquire I Content Title To stu	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of Knowledge of produ Knowledge of Contr Knowledge of Imple	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPC ement the knowledge of encing MPC performa	eas of the indu op floor sched artment is desi g technique C methods in o of ERP systen	ustry. uling. gned to satis crucial areas	of the industr floor schedulir	y. 1g. s covered
iii) (iv) 1 10. Cours stude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iv) <i>A</i> 11. Lab Sr. No. 1	Analyze Control a mpleme rse Outconts. Acquire I Acquire I Acquire I Content Title To stu	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of Knowledge of production Knowledge of Contraction Knowledge of Imple	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPC ement the knowledge of encing MPC performa	eas of the indu op floor sched artment is desi g technique C methods in o of ERP systen	ustry. uling. gned to satis crucial areas	of the industr floor schedulir	y. ng. s covered i)
iii) (iv) 1 10. Courstude i) A ii) A iii) A iii) A iv) A 11. Lab Sr. No. 1 2	Analyze Control a mplements Acquire I Acquire I Acquire I Acquire I Content Title To stu To stu To stu	the concepts of prod and implement PPC nt the knowledge of omes (COs): The c Knowledge of type of Knowledge of produ Knowledge of Contr Knowledge of Imple dy the Factors influ dy the MRP system	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO ement the knowledge of encing MPC performant tem	eas of the indu op floor sched artment is desi g technique C methods in o of ERP systen	ustry. uling. gned to satis crucial areas	of the industr floor schedulir	y. ng. s covered i) i)
iii) (iv) 1 10. Cours stude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iv) <i>A</i> 11. Lab Sr. No. 1 2 3	Analyze Control a mplement rse Outconts. Acquire I Acquire I Acquire I Content Tostu To stu To stu To stu	the concepts of prod and implement PPC int the knowledge of omes (COs): The c Knowledge of type of Knowledge of produ Knowledge of Contr Knowledge of Imple dy the Factors influ dy the MRP system dy the Planning sys dy the Sales and op	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO ement the knowledge of encing MPC performant tem	eas of the indu op floor sched artment is desi g technique C methods in o of ERP system	istry. uling. gned to satis crucial areas as and shop t	of the industr floor schedulin	y. ng. s covered i) i) i)
iii) (iv) 1 10. Counstude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iii) <i>A</i> 11. Lab Sr. No. 1 2 3 4	Analyze Control a mplement rse Outconts. Acquire I Acquire I Acquire I Acquire I Content Totle To stu To stu To stu To stu To stu	the concepts of prod and implement PPC int the knowledge of omes (COs): The c Knowledge of type of Knowledge of produ Knowledge of Contr Knowledge of Imple dy the Factors influ dy the MRP system dy the Planning sys dy the Sales and op	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO ement the knowledge of encing MPC performant tem erations planning. lanning - Master sche	eas of the indu op floor sched artment is desi g technique C methods in o of ERP system	istry. uling. gned to satis crucial areas as and shop t	of the industr floor schedulin	y. ng. s covered i) i) i) i) ii)
iii) (iv) 1 10. Cours stude i) <i>A</i> ii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iii) <i>A</i> iii <i>A</i> <i>i</i> <i>A</i> <i>5</i>	Analyze Control a mpleme rse Outconts. Acquire I Acquire I Acquire I Content Title To stu To stu To stu To stu To stu To stu To stu	the concepts of production of the knowledge of type of	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO ement the knowledge of encing MPC performant tem erations planning. lanning - Master sche	eas of the indu op floor sched artment is desi g technique C methods in o of ERP system ance	istry. uling. gned to satis crucial areas as and shop t	of the industr floor schedulin	y. ng. s covered i) i) i) i) ii) ii)
iii) (iv) 1 10. Counstude i) A ii) A iii) A iii) A iv) A 11. Lab Sr. No. 1 2 3 4 5 6	Analyze Control a mplemen rse Outconts. Acquire I Acquire I Acquire I Acquire I Content To stu To stu To stu To stu To stu To stu To stu To stu	the concepts of production of the knowledge of type of	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning rol and implement PPO ement the knowledge of encing MPC performa tem erations planning. flanning - Master sche Resource Planning nagement using planni	eas of the indu op floor sched artment is desi g technique C methods in o of ERP system ance	istry. uling. gned to satis crucial areas as and shop t	of the industr floor schedulin	y. ng. i) i) i) ii) ii) ii) ii)
iii) (iv) 1 10. Courstude i) A ii) A ii) A iii) A iii iii A iii iii ii ii ii ii ii ii ii ii ii ii	Analyze Control a mpleme rse Outconts. Acquire I Acquire I Acquire I Acquire I To stu To stu To stu To stu To stu To stu To stu To stu To stu To stu	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of Knowledge of produ Knowledge of Contri Knowledge of Contri Knowledge of Imple dy the Factors influ dy the MRP system dy the Planning sys dy the Sales and op dy the Distribution dy the Capacity mar	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning action planning. rol and implement PPO ement the knowledge of encing MPC performa tem erations planning. lanning - Master sche Resource Planning nagement using planni Control system.	eas of the indu op floor sched artment is desi g technique C methods in o of ERP system ance	istry. uling. gned to satis crucial areas as and shop t	of the industr floor schedulin	y. ng. s covered i) i) i) ii) ii) ii) ii) iii) iii)
iii) (iv) 1 10. Cours stude i) A ii) A iii) A iii iii ii A iii ii A ii ii ii A ii ii	Analyze Control a mplemen rse Outconts. Acquire I Acquire I Acquire I Acquire I Content To stu To stu	the concepts of prod and implement PPC <u>int the knowledge of</u> omes (COs): The c Knowledge of type of Knowledge of produc Knowledge of Contra Knowledge of Contra Knowledge of Imple dy the Factors influe dy the MRP system dy the Planning sys dy the Sales and op dy the Production P dy the Distribution dy the CRP and I/O	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning. rol and implement PPO ement the knowledge of encing MPC performa tem erations planning. flanning - Master sche Resource Planning magement using planni Control system. odel	eas of the indu op floor sched artment is desi g technique C methods in o of ERP system ance	istry. uling. gned to satis crucial areas as and shop t	of the industr floor schedulin	y. ng. s covered i) i) ii) ii) iii) iii) iii) iii) iii
iii) (iv) 1 10. Cours stude i) A ii) A iii) A iii) A iv) A 11. Lab Sr. No. 1 2 3 4 5 6 7 8 9	Analyze Control a mpleme rse Outconts. Acquire I Acquire I Acquire I Content To stu To stu	the concepts of prod and implement PPC int the knowledge of omes (COs): The c Knowledge of type of Knowledge of produ Knowledge of Contu Knowledge of Contu Knowledge of Imple dy the Factors influ dy the Factors influ dy the Planning sys dy the Sales and op dy the Production P dy the Distribution dy the CRP and I/O dy the Inventory mo	luction planning. methods in crucial are <u>ERP systems and sho</u> urriculum of the Depa of production planning rol and implement PPO ement the knowledge of encing MPC performa tem erations planning. lanning - Master sche Resource Planning nagement using planni Control system. odel ontrol/scheduling	eas of the indu op floor sched artment is desi g technique C methods in o of ERP system ance	istry. uling. gned to satis crucial areas as and shop t	of the industr floor schedulin	y. ng. s covered i) i) ii) ii) iii) iii) iii) iii) iii) iii)

2. Cour	rse Fuel and	L	Т			Р
Nam				-		
3. Cou		0		0		2
Code	2					
4. Type	e of Course (use tick mark)	Core ()	PE (✔	')	OE ()	
5. Pre-	Engg.	6. Frequency	Even ()	Odd (✔)	Either Sen	Every Sem
requ	isite Thermodynamics	(use tick			0	0
(if aı	ıy)	marks)				
7. Tota	l Number of Lectures, Tuto	orials, Practical (ass	uming 14 we	eeks of one s	semester)	·
Lectures	= 42	Tutorials = 0		Pract	tical = 28	
8. Cour	rse Description					
Гwo and	four stroke engines, air sta	ndard cycles, fuels	and combus	tion, fundan	nental of igr	ition systems
performar	nce and rating of engines, con	nbustion characteristi	ics and comb	oustion cham	ber for S.I a	nd C.I engines
superchar	ging.					
9. Lear	ning objectives:					
i) T	o learn about various types of	f fuels, their composi	tion and prop	perties		
ii) T	o acquire depth knowledge of	f solid, liquid and gas	eous fuels.			
iii) T	o understand the thermodyna	mics of combustion.				
iv) T	o learn about the types of pol	lution and its control				
	rse Outcomes (COs): On con	-			ole to	
	nalyze the composition of va	• •				
	stimate the composition of va	• •		perties.		
iii) D	emonstrate the knowledge of	combustion thermod	ynamics.			
	cquire the knowledge of Stoi	chiometry of Fuel an	d Kinematic	s of Combus	tion.	
11. Lab						
Sr. No.	Title) s covered
1	Temperature dependence of		÷	dwood Visc	ometer.	i), ii)
2	Flash and Fire points of Die	esel, K-Oil, Bio Diese	el.			i), ii)
3	Flash and Fire points of lub	pricants.				i), ii)
4	Drop point of grease and m	*	in grease			i), ii)
5	Calorific value of liquid fue	el.				i), ii)
6	Calorific value of gaseous f	fuel temperatures				iv)
6						
7	Study of semi solid lubricat	tion in various Auton	nobile Unit &	& Joints		ii)
	Study of semi solid lubricat Study of lubrication in trans					ii) ii)

2. Course Name	Estimation &		L		Т		Р	
	Costing Lab							
3. Course Code			0	0			2	
4. Type of Course	e (use tick mark)	Core ()	EAS ()	PE (✓)	OE ()		
5. Pre-requisite (if any)		6. Frequer marks)	ncy (use tick	Even O	Odd (✔)	Either Sem ()	Every Sem ()	
7. Total Number	of Lectures, Tutorials	s, Practical (ass	uming 14 weeks	s of one se	mester)		1	
Lectures = 0		Tutorials =	0	Praction	cal = 28			
8. Course Descrip	otion							
This is a course in E	stimation & Costing is	a new approach	for product cost	testimating	g in mecl	nanical pro	oduction	
is proposed within t	he framework of integ	rated product er	ngineering. The a	approach i	ntroduce	s the new	concep	
of Cost Entity. It	is made necessary due	e to the current	t context of gro	wth of in	direct co	osts, espec	cially ir	
manufacturing. The	e objective, i.e. establ	ishing a tight l	ink between tee	chnical va	riables (or manuf	acturing	
features) and econo	mic variables (modele	ed as Cost Entit	ies), requires to	model the	e reasoni	ing proced	lure and	

9. Learning objectives:

associated knowledge related to cost estimating.

- i) The student can identify different areas of Engineering Costing & Estimating.
- ii) To address the underlying concepts, methods and application of Engineering Costing & Estimating.
- iii) Understanding the concept of Depreciation & Break-Even Analysis and Estimating.
- iv) The student can identify different areas of Budgetary control, securing flexibilities of budgeting.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) To present a problem oriented in depth knowledge of Engineering Costing & Estimating.
- ii) To address the underlying concepts, methods and application of Engineering Costing & Estimating.
- iii) Understanding the concept of Depreciation & Break-Even Analysis and Estimating.

iv) Understanding the concept of Budget, Budgetary Control and Engineering Contracts.

Sr. No.	Title	COs covered
1	To Study the Difference between Estimating and Costing.	i)
2	To Study the Elements of PPC and Time & Motion Studies.	i)
3	To study how to find out the Cost of raw materials.	ii)
4	To Study the methods of wage payments for direct and indirect labor time wage system.	ii)
5	To Study the factors influencing wage rate.	ii)
6	To study the calculation of breakeven point.	iii)
7	To study the statistical estimation.	iii)

8	To study the machine hour basis method	iii)
9	To study the Preparing an annual budget for the Engineering Department	iv)
10	To study the Cash flow schedules.	iv)
11	To study the Operational and capital budgets.	iv)

1. Name of the Department	- Mechanical Engineerii	ng				
2. Course Name Total Qu	ıality	L		Т		2
Manager	ment Lab					
3. Course Code		0		0		2
4. Type of Course (use tick	mark) Core ()	EAS ()	PE (✓)	OE ()	
5. Pre-requisite	-	iency (use tick	Even	Odd	Either	Every
(if any)	mark	s)	0	(✔)	Sem ()	Sem
						0
7. Total Number of Lecture	es, Tutorials, Practical (a	assuming 14 weeks	s of one se	mester)		
Lectures = 0	Tutorials	= 0	Practi	cal = 28		
8. Course Description						

To give the students an overview of quality and TQM and explaining the salient contributions of Quality Gurus like Deming, Juran and Crosby. General barriers in implementing TQM.

9. Learning objectives:

- i) To learn the basic concepts of quality and quality from organizational point of view.
- ii) To learn the concept of total quality management from different philosophical approach.
- iii) To learn the internal politics, quality culture, education and training of the organization.
- \mathbf{iv}) To be aware of international/national Quality standards.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Understanding the concept of TQM principle.
- ii) To address the underlying concepts of Tools & Techniques for Quality management-I
- iii) Understanding the concept of Tools & Techniques for Quality management-II
- iv) Understanding the concept of Quality Systems

11. Lab Content			
Sr. No.	Title	COs covered	
1	To Study the PDCA cycle in TQM using case study	i)	
2	To Study the Contributions of Deming in TQM using case study.	i)	
3	To study the Juran and Crosby in TQM using case study	i)	
4	To Study the sampling distribution, and hypothesis Testing of Quality	ii)	
5	To Study the Measurement system analysis, Analysis of Variance (ANOVA) using Design and Analysis of Experiment (DOE)	ii)	
6	To study the Measurement system analysis using Analysis of Variance (ANOVA)	ii)	
7	To study the Quality functions development process	iii)	
8	To study the Failure mode effect analysis process	iii)	

9	To study the quality management systems using case study	iv)
10	To study the software quality.	iv)

2. C	Course Name	Tool Design lab	L	Т		Р	
3. C	Course Code		0	0		2	
4. T	Type of Course (use tio	ck mark)	Core ()	PE (✓)		OE ()	
5. P	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. T	otal Number of Lectu	ires, Tutorials, Practi	ical (assuming 14 v	weeks of o	one sem	ester)	1
L	ectures = 00		Tutorials = 00	Pra	actical =	28	
8. C	Course Description						
i)		of this course is to prov	vide the basic know	ledge nee	ded to e	xplore the	discipline
ii) iii) iv) 10. C i)	The main objective of tool design and engir Implement the tool de Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd	neering. esign process when de evaluate cutting tools ntional techniques in cr s): uction, regulation of sp	signing tooling for and work holders for reating tooling draw peed and feeds.	the manuf or a manu vings.	facturing Ifactured	g of a produ	-
ii) iii) iv) 10. C i) ii) iii)	The main objective of tool design and engin Implement the tool de Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd To learn the designin To understand mecha	eering. esign process when dea evaluate cutting tools ntional techniques in cr s): uction, regulation of sp g of machine tool structure unical properties of ma	signing tooling for and work holders for reating tooling draw peed and feeds. ctures and its constru- terials and testing.	the manuf or a manu vings.	facturing Ifactured	g of a produ	-
ii) iii) iv) 10. C i) ii) iii) iv)	The main objective of tool design and engin Implement the tool de Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd To learn the designin	eering. esign process when dea evaluate cutting tools ntional techniques in cr s): uction, regulation of sp g of machine tool structure unical properties of ma	signing tooling for and work holders for reating tooling draw peed and feeds. ctures and its constru- terials and testing.	the manuf or a manu vings.	facturing Ifactured	g of a produ	-
ii) iii) iv) 10. C i) ii) iii) iv)	The main objective of tool design and engir Implement the tool de Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd To learn the designin To understand mecha To learn about advan	eering. esign process when dea evaluate cutting tools ntional techniques in cr s): uction, regulation of sp g of machine tool structure unical properties of ma	signing tooling for and work holders for reating tooling draw peed and feeds. ctures and its constru- terials and testing.	the manuf or a manu vings.	facturing factured	g of a produ	uct
ii) iii) iv) 10. C i) ii) iii) iv) 11 Sr.	The main objective of tool design and engir Implement the tool design, develop, and Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd To learn the designin To understand mecha To learn about advan . Lab Content Title	eering. esign process when dea evaluate cutting tools ntional techniques in cr s): uction, regulation of sp g of machine tool structure unical properties of ma	signing tooling for and work holders for reating tooling draw peed and feeds. ctures and its constructions plications.	the manuf or a manu vings.	facturing factured	g of a produ product	uct
ii) iii) iv) 10. C i) ii) iii) iii) iv) 11 Sr. No.	The main objective of tool design and engir Implement the tool design, develop, and Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd To learn the designin To understand mecha To learn about advan . Lab Content Title To study of function	heering. esign process when de- evaluate cutting tools ntional techniques in cr s): uction, regulation of sp g of machine tool structure unical properties of ma ce materials and its ap	signing tooling for and work holders for reating tooling draw beed and feeds. ctures and its constru- terials and testing. plications.	the manuf or a manu vings.	facturing factured	g of a produ l product COs cover i), ii),	red
ii) iii) iv) 10. C i) ii) iii) iv) 11 Sr. No. 1	The main objective of tool design and engir Implement the tool design, develop, and Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd To learn the designin To understand mecha To learn about advan . Lab Content Title To study of function Study of working an	heering. esign process when dea evaluate cutting tools intional techniques in cr s): uction, regulation of sp g of machine tool structure inical properties of ma ce materials and its ap	signing tooling for and work holders for reating tooling draw peed and feeds. ctures and its constructions plications.	the manuf or a manu vings.	facturing factured	g of a produ l product COs cover i), ii),	red , iii), iv)
ii) iii) iv) 10. C i) ii) iii) iii) iv) 11 Sr. No. 1 2	The main objective of tool design and engir Implement the tool design, develop, and Design, develop, and Use CAD and conver Course Outcomes (CO To understand introd To learn the designin To understand mecha To learn about advan Lab Content Title To study of function Study of working an Design criterion for	heering. esign process when dest evaluate cutting tools intional techniques in cr s): uction, regulation of sp g of machine tool structure unical properties of ma ce materials and its ap hal requirements of ma nd auxiliary motion of	signing tooling for and work holders for reating tooling draw peed and feeds. ctures and its constru- terials and testing. plications. chine tools. machine tools e, Static & dynamic	the manuf or a manu vings.	facturing factured	g of a produ l product COs cover i), ii),	red iii), iv)

6	Study of different mechanism used for transforming rotary motion into translatory motion. (Application and sketching of Slider-crank mechanism, Cam mechanism, Rack & pinion mechanism, Nut & screw mechanism.	v)
7	Discuss various device for intermittent motion and draw the schematic diagram for various application. (Application and sketching of Ratchet gear mechanism, Geneva mechanism, Reversing mechanism, Differential mechanism, Norton mechanism, Mender's mechanism.).	i), ii), iii), iv)
8	Step turning and taper turning on lathe	i), ii), iii), iv)
9	Thread cutting and knurling on lathe	i), ii), iii), iv)
10	To machine flat surface using shaper machine	i), ii), iii), iv)
11	To perform drilling, taping and grinding operation.	i), ii), iii), iv)
12	Lathe tool and drill tool dynamometers	i), ii), iii), iv)
13	Grinding of single point cutting tool	i), ii), iii), iv)

1. Name	e of the Depar	tment- Mechanical	Engineering				
2. Cour	se Name	Composite Materials Lab	L	Т		Р	
3. Cour	se Code		0	0		2	
4. Type	of Course (us	e tick mark)	Core ()	PE (✓)		OE ()	
5. Pre-r any)	requisite (if		6. Frequency (use Even () Odd tick marks) (✓)			Either Sem ()	Every Sem ()
			,				Sem ()
		ectures, Tutorials, P	Practical (assuming 14 we)	
Lectures	= 0		Tutorials = 0	Practica	al = 28		
8. Cour	se Description						
Composit	as are a unique	a class of materials m	nade from two or more dis	tinct mate	rials that y	when com	bined ar
-	-						
		· · ·	are non-corroding, non-m	•	-		•
•	•	•	where it is needed. This of				• •
-		-	bout design and manufac	-			-
composite	es. Joining me	ethod and failure the	eories for composites are	also disc	cussed in	this cours	se. Sinc
composite	es are affordabl	e high-performance i	naterial and expanded corr	mercial as	well as ir	dustrial ut	tilization
-	s course is quite	e 1	•				
	1						
9. Lear	ning objectives	5:					
i)	To understan	d the properties and c	lesign of composite materi	als.			
ii)			ring methods for composit				
iii			composite structures and a		lure mode	s.	
iv			equirements associated wit				
Course C			this course, the students w			0	
i)		· ·	e materials for various app				
ii)	•		ain relationship of compos		ls		
	-	-	components materials				
iv			ntal properties of composit	e materials	3		
10. Lab			F		-		
Sr. No.	Title					COs co	vered
1	Preparation of	f Continuous Fiber r	einforced Polymer Compos	sites		i),	, iii)
2	Preparation of	of Dis-Continuous Fib	per reinforced Polymer Con	nposites			i)
3	Study of Ten	sile strength and you	ng's modulus of FRP comp	osites		i).	, ii)
4	Study of Ten	sile strength of Al-Si	C composites			i).	, ii)
5	Study of mic	rostructure, hardness	and density of Al-SiC con	posite		i),	iii)
6	Environment	al Testing (Humidity	and temperature)			i).	, ii)
7	Study of Har	dness of FRP compos	sites			ii)	, iii)
8	Study of Flex	sural strength of FRP	composites			ii)	, iii)
	1					1	11

9	Study of drop weight impact testing	ii) ,iii)
10	Preparation of Al-SiC composites by stir casting method	i), ii)

4th Semester

1. Name of the Department	ment- Mechanical Eng	gineering			
2. Course Name	Mechanical Machine Design	L	Т	Р	
3. Course Code		3	0	0	
4. Type of Course (us	e tick mark)	Core (✓)	PE ()	OE ()	
5. Pre-requisite (if any)	Machine Drawing & SOM	6. Frequency (use tick marks)	~	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 42	Tutorials = 00	Practical = 00

8. Brief Syllabus

Design of Machine Elements is a required course for mechanical engineering students. This course is an introduction to the basic principles of modern engineering. It provides the students with fundamental skills of engineering and the ability to apply the theories of science to practice and understand the factors; such as stresses, deformations, and failure criteria, influencing the machine elements like shafts, springs, belts, bearings, gears etc. The main objective of design of machine element is that the machine should function properly to satisfy the needs of the customer and it should be safe against the predicted modes of failure.

9. Learning objectives:

- i) To understand the design methodology for machine elements.
- ii) To analyze the forces acting on a machine element and apply the suitable design methodology.
- iii) To understand the various standards and methods of standardization.
- iv) To apply the concept of parametric design and validation by strength analysis.

10. Course Outcomes (COs): After successful completion of the course, student will be able to

- i) understand the basic of mechanical design process and design of simple machine components like shaft, key, coupling, lever power screw etc.
- ii) select various flexible power transmitting device such as belt drives such as belt drive and chain drive from manufacture's catalogue.
- iii) apply the knowledge of computer aided drafting tools to prepare production drawings of machine components.
- iv) determine tolerances for proper fit to achieve functional requirements of assembly

11. Unit wise detailed content

Unit-1	Number of lectures = 12	Title of the unit: Design Consideration of Machine Parts

Loads, different types, factor of safety, stress, design stress factors affecting its selection, determination of factor of safety, tensile, compressive, shear, bending, bearing, crushing stresses, bending and torsional shear stress, transverse shear, principal stress determination, eccentric loading, bearing pressure.

Unit – 2	Number of	Title of the unit: Keys and Couplings
	lectures = 10	

Design of sunk keys, design of a muff, clamp, flange (protected type) and bushed pin type of flexible coupling. Power Screws: Types of threads, design of screw with different types of threads used in practice.

Unit – 3	Number of	Title of the unit: Shafts
	lectures = 08	
	lectures = 08	

Design stress, design of axles, spindles and shafts on the basis of strength, based on Rankine's and Guests' theory, design of shafts on the basis of rigidity. Design of Joints, Flat and V Belt drives, design of pulleys for these drives

Unit – 4	Number of	Title of the unit: Design of Springs and Engine parts
	lectures = 12	

Wahls' factor and its use in design of spring, effect of end connections on design of compression spring, design of helical tensile spring and compression spring for circular wire. Buckling of compression spring. Length and number of turns calculation, design of leaf spring. Design of Parts

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) V B Bhandari, "Design of Machine Elements", TMH Publications, Fourth Edition, 2017, ISBN: 9789339221126

Reference Books

i) V B Bhandari, Introduction to Machine Design, TMH Publications

ii) 7P. Kannaiah, Machine design by, Scitech Publication

iii) J E Sighley, Mechanical Engineering Design, TMH Publications

iv) Norton. R. L, Design of Machinery, TMH Publications

2.	Course Name	Manufacturing Processes and Technology	L	Т		Р	
3.	Course Code		3	0		0	
4.	Type of Co tick mark)	urse (Name use	Core (✓)	PE ()		OE ()	
5.	Pre- requisite (if any)		6. Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem (
7.		,	torials, Practical (as	0		one semester	•)
Lectures = 42 Tutorials = 0 Practical = 0					al = 0		
In for ne tha ge	rming operati edful to a me at has a usefu ometry. Usua ceptable. A to	to introduce about n ons, machine tool, p chanical engineer. T l form. This form is illy this geometry ha	nanufacturing process lastic processing and he fundamental idea most likely predetern s certain tolerances th geometric accuracy t	other import of manufact nined, calcunat it must n	rtant things turing or pr lated, with neet in orde	which are v roduction is t a certain phy er to be const	ery to create ysical idered
In for ne tha ge acc pro	this syllabus rming operati edful to a me at has a usefu ometry. Usua ceptable. A to occess. Learning o i) To ii) To iii) To iii) To ma iv) To	to introduce about n ons, machine tool, p chanical engineer. T l form. This form is illy this geometry ha olerance outlines the bjectives: understand the principles develop the knowled nufacturing and proc acquire basic knowl	lastic processing and he fundamental idea most likely predetern s certain tolerances th geometric accuracy t ciples of manufacturin of metal forming proo lge of selecting the ri luction. edge about the behav	other import of manufact nined, calcu- nat it must n that must be ng processes cesses and n ght equipmo- ior and man	rtant things curing or pr lated, with neet in orde achieved in s. netrology. ent for a pa	s which are v coduction is t a certain phy er to be const in the manufa	ery to create ysical idered acturing
for nea tha geo acco pro 9. 10.	this syllabus rming operati edful to a me at has a usefu ometry. Usua ceptable. A to occess. Learning o i) To ii) To iii) To iii) To eng . Course Our i) To iii) To iii) To iii) To iii) To iii) Exp	to introduce about n ons, machine tool, p chanical engineer. T l form. This form is illy this geometry ha olerance outlines the bjectives: understand the principles of develop the knowled nufacturing and prod acquire basic knowl gineering materials a tcomes (COs): understand the basic study the metrology	lastic processing and he fundamental idea most likely predetern s certain tolerances th geometric accuracy to tiples of manufacturin of metal forming prod lge of selecting the ri- luction. edge about the behav nd concepts of maching and measurement me- tal forming and sheet	other import of manufact nined, calcu- nat it must n that must be ng processes cesses and n ght equipmo- ior and man ne tools.	tant things turing or produced in order achieved in achieved in achieved in achieved in a produced in a product of the second se	s which are v coduction is t a certain phy er to be const in the manufa nuticular appl properties o	ery to create ysical idered acturing ication of f

Introduction, basic tool geometry, single point tool nomenclature, chips types and their characteristics, mechanics of chips formation, theoretical and experimental determination of shear angle, orthogonal and oblique metal cutting, metal cutting theories, relationship of velocity, forces, and power consumption, cutting speed, feed and depth of cut, cutting fluids, coolants, lubricants,

temperature profile in cutting, tool life relationship, tailor equation of tool life, tool material and mechanism, machinability.

mechanism, ma	achinability.	
Unit – 2	Number of lectures = 10	Title of the unit: Metrology and measurements
mechanical, ele gauging, Gauge Influencing sur	ctrical, optical, sine b design; surface finisl face finish and evalua	nts, Linear and angular instruments; slip gauges, comparator- ar, angle gauges, tape gauge, screw thread measurements limit h and its measurements, micro and macro deviation, factors tion of surface finish. Limits, fits and tolerances, types of limits, e basis system, shaft basis system.
Unit – 3	Number of lectures = 10	Title of the unit: Metal Forming and Sheet Metal Operations
classifications of metal forming p selection, sheet operations: cutt embossing, dra	of forming processes, processes, basics of sl temperature: cold, wa ting, punching, blanki wing, deep-drawing,	of Hot & Cold Working, Hot & Cold Working Processes, Bulk forming processes: Rolling, Extrusion, Forging. Sheet neet metal working, sheet material selection, sheet thickness arm, hot forming, sheet metal forming operations, shearing ng, notching, lancing. Forming operations: bending, beading, spinning. Dieless forming processes- Incremental Sheet Forming ers of ISF, working principle and applications of ISF
Unit – 4	Number of lectures = 10	Title of the unit: Machine Tools
such as lathe, sl working princip	haper, planner, drilling ble of lathe, milling, d	specialization, operations and devices of basic machine tools g machining, and milling machine, indexing in milling operation, rilling, shaper, planer machine tools, feed, spindle speed, depth nachining time, Current industry trends.
The students with	_	ng / E-learning component earn using the SGT E-Learning portal and choose the relevant of SGT University.
The link to the	E-Learning portal.	
https://sgtlms.o	rg	
Journal papers;	Patents in the respect	ive field.
13. Books Rec	ommended	
Text Book		
	o, Vol. 1, Foundry, Fo 6-050-0.	orming and Welding, McGraw Hill, 5th Edition, ISBN-13: 978-
Reference Boo	ks	

- i) Workshop Technology (Manufacturing Process) S K Garg, Laxmi Publications; Fourth edition (2018), ISBN-10: 8131806979
- ii) Ajay, R.K. Mittal, Incremental Sheet Forming Technologies: Principles, merits, limitations, and applications, CRC Press, Taylor and Francis, ISBN: 978-0-367-27674-4.

2. Course Name	Research Methodology	L	Г	[Р
3. Course		2		<u> </u>		0
3. Course Code		3	0	,		0
4. Type of C	ourse (use tick	Core ()	PE ()		OE ()	EAS (
mark) 5. Pre-	None	6. Frequency	Even	Odd	Either	Evory
requisite (if any)	None	6. Frequency (use tick marks)		0	Sem ()	Every Sem ()
7. Total Nur	nber of Lectures, T	utorials, Practical (assum	ing 14 w	eeks of	one seme	ester)
Lectures = 42		Tutorials =0	Practic			,
8. Course D	escription					
potential researche findings to the scie students to bring a foray through intel 9. Learning i) Develo ii) Analyz iii) Unders values. iv) Develo 10. Course O i) Identify ii) Analyz researc iii) Unders	ers the knowledge of entific and technologi bout their creative ide lectual ownership. objectives : Students op the ability to perfo- te the available resea tand the role of comp op technical writing a utcomes (COs): On y and solve the resea te the available data h problems. tand the soft comput	to identify research proble effectively analysing and it cal community of the world eas for innovation and estal undergoing this course are rm research related activiti rch data for given research puters in available data ana <u>and presentation skills.</u> completion of this course, rch problem in conjunction effectively and apply the ing, plagiarism and follow search findings with the co	the stude net of the stude	d to estarch d to nts will erature. test of ethics.	s and pres o aims at r impact in the reseau be able: hypothes	enting the notivating the global rch ethical
11. Unit wise	detailed content					
Unit-1	Number of	Title of the unit: Introd	luction to	o Resea	rch Prob	lem
	lectures = 11	Formulation and Desig	n			
problem, importan secondary sources web, critical literat of working hypoth	nce of literature re , reviews, monograp ture review, identifying esis.	h problem, selecting the view in defining a prob h, patents, research databa ng gap areas from literature	lem, liter ases, web and rese	rature r as a sc arch dat	eview-pri ource, sear abase, dev	mary and rching the velopment
Unit – 2	Number of lectures = 11	Title of the unit: – Data	a Collecti	ion and	Analysis	
collection, aspects	of method validatio	s, literature analysis, avo n, observation and collect	ion of da	ta, samj	pling met	hods, data
		ools, data analysis with sta				
Unit – 3	Number of lectures = 10	Title of the unit: Soft C	omputin	g & Re	search E	tnics
Computer and its	role in research Use	of statistical software in re	search I	ntroduc	tion to ev	olutionary

Ethics-ethical issues, design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

Unit – 4	Number of	Title of the unit: Interpretation and Report Writing
	lectures = 10	

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

12	Declar Decommended					
13.	Books Recommended					
Text]	Book:					
i)	Kumar, R. (2010), "Research Methodology: A Step-by-Step Guide for Beginners", United					
	Kingdom: SAGE Publications, ISBN: 9781446244777, 1446244776.					
ii) Kothari, C. R. (2004), "Research Methodology: Methods and Techniques", India: New Age						
	International (P) Limited, ISBN: 9788122415223, 8122415229					
Refer	rence Books:					
i)	Sinha, S.C. and Dhiman, A.K., (2002), "Research Methodology (set of Two					
	Vol.)", India: Ess Ess Publications, ISBN: 9788170003243, 8170003245.					
ii)	Trochim, W. M. K. (2001), "Research Methods Knowledge Base", Germany: Atomic Dog					
	Publication, ISBN: 9780970138590, 0970138598.					
iii)	Wadehra, B. L. (2004), "Law Relating to Patents, Trade Marks, Copyright, Designs and					
	Geographical Indications", India: Universal Law Publication, ISBN: 9788175343825,					
	8175343826.					

Department Electives-III

1.	Name of the Depar	tment- Mechanical E	ngineering				
2.	Course Name	Cryogenic	L]	Г]	Р
		Engineering					
3.	Course Code		3	()	(0
4.	Type of Course (us	e tick mark)	Core ()	PE (✔)		OE ()	
5.	Pre-requisite (if	Refrigeration &	6. Frequency (use	Even	Odd ()	Either	Every
	any)	Air conditioning,	tick marks)	(✔)		Sem ()	Sem ()
		Applied					
		Thermodynamics					
7.	Total Number of L	ectures, Tutorials, Pr	actical (assuming 14 wee	ks of one	semester)	
Le	ctures = 42		Tutorials = 0	Practica	l =0		
8.	Course Description	l					
Int	roduction to Cryoger	nics and its application	ons, Properties of cryoge	nic fluids	, Properti	es of ma	terials at
cry	ogenic temperature,	Cryogenic Refrigeration	on Systems, Gas-liquefac	tion system	ms, Cryo	coolers, C	ryogenic
			ation in Cryogenics, Liqu	id storage	e and trar	nsfer syste	ems, heat
	changers used in cryo	- ·					
9.	Learning objective	s:					
	i) To provide in-de	epth knowledge of low	temperature science.				
	ii) To provide know	wledge on the propertie	es of materials at low temp	erature.			
	iii) To familiarize w	vith Cryogenic refrigera	ation systems.				
	iv) To familiarize w	ith various gas liquefa	ction systems.				
	v) Cryogenic stora	ge and transfer lines					
10	. Course Outcomes ((COs): The students with	ill be able to				
	i) Understand the	science of cryogenic te	mperatures.				
	ii) Know about Cry	ogenic refrigeration sy	vstems.				
	iii) Get ideas on cry	ogenic fluids.					
	iv) Understand the	working of cryogenic i	nstrumentation and cryoge	nic heat e	xchangers	5.	
11.	. Unit wise detailed o	content					
Un	it-1	Number of	Title of the unit: Introd	uction			
		lectures = 10					
Int	roduction to Cryogen	ics, properties of cryog	enic fluids like Oxygen, N	litrogen, A	rgon, Ne	on, Florin,	Helium,
Hy	drogen. Properties of	material at cryogenic	temperature- mechanical,	thermal, m	nagnetic a	nd electric	cal-Super
cor	nductivity, application	n of cryogenic systems	in space, medical, industri	es, biolog	ical etc.		
Un	it – 2	Number of	Title of the unit: Cryog	enic Refr	igeration		
		lectures = 12			-		
Pri	nciple and Methods o	f production of low terr	perature and their analysis	: Joule Th	omson ex	pansion, A	Adiabatic
	-	-	ascaded System, Magnetic			-	
Ga	s liquefaction & sep	aration systems: Liqu	efaction systems for Neo	n. Hydrog	gen and H	Ielium. C	ryogenic
		• •	stems. Refrigeration using				
	frigerators using solic		-	_	-		
	it – 3	Number of	Title of the unit: Cryog	enic Syste	em and ir	strument	ation
		lectures = 09		·			
Cry	yogenics Heat Exchar	igers, Compressors, Ex	panders, Effect of various	parameter	s in perfo	rmance an	d system
-	-	• •	oams, gas filled, fibrous,	-	-		-
-		-	ge and transfer of cryogen		-		-
		,					

of instrumentation, strain displacement, pressure, flow, liquid level, density and temperature measurement in cryogenic range.

Unit – 4	Number of	Title of the unit: Safety in Cryogenics & its	
	lectures = 11	applications	

Safety in cryogenic fluid handling, storage and use. Safety against cryogen hazards: Physical hazards, Chemical hazards, Physiological hazards, combustion hazards, oxygen hazards, accidents in cryogenic plants & prevention. Super conductive devices such as bearings, motors, cryotrons, magnets, D.C. transformers, tunnel diodes, space technology, space simulation, cryogenics in biology and medicine, food preservation and industrial applications, nuclear propulsions, chemical propulsions

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

 Randall F. Barron, "Cryogenics Systems", Second Edition, Oxford University Press, New York (1985). (ISBN-10: 0070038201, ISBN-13: 978-0070038202)

Reference Books:

- i) Timmerhaus, Flynn, "Cryogenic Process Engineering", Plenum Press, New York (1989). ISBN:978-1-4684-8758-9)
- ii) Thomas M. Flynn, "Cryogenic Engineering", second edition, CRC press, New York (2005), ISBN: 9780824753672)

1. Name of the Department- Mechanical Engineering						
2. Course Name	Computer Aided Manufacturing	L	Т	Р		
3. Course Code		3	0	0		
4. Type of Course (use	e tick mark)	Core ()	PE (✓)	OE ()		
5. Pre-requisite (if any)	Workshop Technology	6. Frequency (use tick marks)	Even () Odd (••)	Either Every Sem () Sem ()		

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 42	Tutorials =	Practical = 00

8. Brief Syllabus

CAD is the use of computer systems to assist in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. Students learn the importance of CAD/CAM principles in the Product development, programs related to manufacturing using codes and analyze the importance of networking in manufacturing environment.

9. Learning objectives:

- i) To understand the basics of CAD/CAM and concepts of computer graphics.
- ii) To learn about the geometric issues concerned to the manufacturing and its related areas.
- iii) To understand the latest advances in the manufacturing perspectives and their applications.
- iv) To learn about the concept of group technology and computer integrated manufacturing.

10. Course Outcomes (COs):

- i) To understand the importance of CAD/CAM principles and computer hardware in the Product development.
- ii) To understand the principles of computer graphics.
- iii) To develop programs related to manufacturing using codes.
- iv) To learn the concepts of group technology, flexible manufacturing system and computer integrated manufacturing system.

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Title of the unit: Computer Hardware

Product Development Cycle – Introduction to CAD/CAM – Graphics input devices- cursor control devices, Digitizers, Scanners, speech oriented devices and touch panels, Graphics display devices – CRT, color CRT monitors, DVST, Flat- panel display, Graphics output Devices – Printers and Plotters – Graphics Standards – Neutral File formats –IGES, STEP.

Unit – 2	Number of	Title of the unit: Principles of Computer Graphics
	lectures = 10	

Geometric Modeling – Wireframe, Surface and Solid – CSG and B-Rep- World/device co-ordinate representations, 2D and 3Dn geometric transformations, Matrix representation-translation, scaling, shearing, rotation and reflection, composite transformations, concatenation – Graphics software, Graphics functions, output primitives- Bresenham's Algorithm and DDA.

Unit – 3	Number of	Title of the unit: CNC Machine Tools
	lectures = 10	

Introduction to NC, CNC, DNC- Manual part Programming – Computer Assisted Part Programming – Examples using NC codes- Adaptive Control – Canned cycles and subroutines – CAD / CAM approach to NC part programming – APT language, machining from 3D models.

Unit – 4	Number of	Title of the unit: Group Technology, CAPP, FMS, and CIM
	lectures = 12	

Introduction to part families-parts classification and cooling – group technology machine cells-benefits of group technology – Process Planning – CAPP & types of CAPP – Flexible manufacturing systems (FMS) – the FMS concept-transfer systems – head changing FMS – Introduction to Rapid prototyping, Knowledge Based Engineering. CIM wheel – CIM Database- CIM-OSI Model– Networking Standards in CIM Environment – Network structure – Network architecture –TCP/IP, MAP – Virtual Reality, Augmented Reality- Artificial Intelligence and Expert system in CIM, Current industry trends.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

 Mikell P. Groover (2016), Automation, Production Systems and Computer Integrated Manufacturing, 4th Edition, Pearson Education. ISBN: 978-9332572492.

Reference Books

- i) Ibrahim Zeid (2009), Mastering CAD/CAM, 2nd Edition, Tata McGraw Hill International Edition, ISBN: 9780070634343.
- ii) P N Rao (2010), CAD/CAM Principles and Applications, 3rd Edition, Tata McGraw-Hill Education, ISBN: 9780070681934.
- iii) James A. Rehg and Henry W. Kraebber (2004), Computer Integrated Manufacturing, 3rd Edition, Pearson Education, ISBN: 978-0131134133.
- iv) Mikell P. Groover and Emory W. Zimmers (2003), CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall Edition, ISBN: 978-8-177-58416-5.

1. Name of t	he Depart	tment- Mechanical E	Ingineering				
2. Course Na	ame	Hydrogen and Fuel Cells	L]	Г]	Р
3. Course Co	ode		3		0		0
4. Type of C	ourse (use	e tick mark)	Core ()	PE (✔)		OE ()	
5. Pre-requis	site (if	IC Engines,	6. Frequency (use	Even	Odd ()	Either	Every
any)		Automobile	tick marks)	(✔)		Sem ()	Sem ()
		Engineering					
		ectures, Tutorials, P	ractical (assuming 14 wee)	
Lectures = 42			Tutorials = 0	Practica	$\mathbf{l} = 0$		
8. Course De	-						
•			w on Hydrogen and Fuel			understa	nding the
		·	ow to store and utilize these	e energies.	•		
9. Learning	-					_	
	0	•	de comprehensive and logi	cal knowle	edge of hy	drogen pr	oduction.
	0	orage and utilization	• •				
· •		•	is fuel cell technologies				
		lication of Fuel cells.					
10. Course Ou	,		1 1.00 /	1			
	-		under different operating		•		
		** *	l technology for a given ap	-	h fra1 aa11	~~~	
			storage system to be used			•	
11. Unit wise			ciated with the use of hydr	ogen stora	ige and tu		mology.
Unit-1		Number of	Title of the unit: Introd	uction of	hudnogon	onongu a	vatoma
UIIIt-1		lectures = 10			nyurogen	energy s	ystems
Properties of	hydrogen		pathways introduction-c	urrent us	es gener	al introdu	iction to
_			ction, storage, dispensing a		-		
plants.					,	, ar o 8011 p	
Unit – 2		Number of	Title of the unit: Hydro	gen prodi	iction pro	ocesses	
		lectures = 10		B F	F		
Thermal-Steam	n reformat		water splitting, gasification	on-pyrolys	sis, nuclea	r thermal	catalytic
			ical-Electrolysis, photo el				
•		nicro-organism, PM b	• •			U	
Unit – 3		Number of	Title of the unit: Hydro	gen Stora	ge and ut	ilization	
		lectures = 11					
Physical and ch	hemical pr	operties, general stora	ge methods, compressed st	orage-con	nposite cy	linders, gl	ass micro
sphere storage,	, zeolites,	metal hydride storage	e, chemical hydride storag	e and cryo	ogenic sto	rage, carb	on-based
materials for h	ydrogen st	torage.					
Overview of h	ydrogen u	tilization, IC Engines	, gas turbines, hydrogen b	urners, po	wer plant,	domestic	cooking
gas, marine ap	plications,	hydrogen dual fuel e	ngines.				
Unit – 4		Number of	Title of the unit: Fuel co	ells and It	s applicat	tions.	
		lectures = 11					
History – princ	ciple - wo	rking - thermodynam	ics and kinetics of fuel cel	1 process	- perform	ance eval	uation of
	-	-	Types of fuel cells – AFC, F	AFC, SO	FC, MCFO	C, DMFC,	PEMFC,
microbial fuel	cells, relat	ive merits and demer	its.				

Fuel cell usage for domestic power systems, large scale power generation, Automobile, Space, economic and environmental analysis on usage of hydrogen and fuel cell. Future trends in fuel cells, portable fuel cells, laptops, mobiles, submarines.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Sorenson B, Hydrogen and Fuel Cells: Emerging Technologies and Applications, Bent Sorenson, Academic Press (2005), ISBN:0126552819.

Reference Books

- i) Hordeski MF, Alternative Fuels: The Future of Hydrogen, CRC Press, 3rd Edition, 2013, ISBN: 9781466580244.
- **ii**) Busby RL, Hydrogen and Fuel Cells: A Comprehensive Guide, Penn Well Books, American Edition, (2005), ISBN: 1593700431.

	nent- Mechanical En	6 6	T		D
2. Course Name	Plant Layout and	L	Т		Р
	Material				
	Handling				
3. Course Code		3	0		0
4. Type of Course (use	tick mark)	Core ()	PE (✔)	OE ()	
5. Pre-requisite (if		6. Frequency (use	Even Odd	l () Either	Every
any)		tick marks)	(✔)	Sem ()	Sem ()
7. Total Number of Le	ctures, Tutorials, Pr	actical (assuming 14 wee	ks of one seme	ster)	•
Lectures = 42		Tutorials = 0	Practical = 0		
8. Course Description		L	L		
-	yout and Material H	andling Objectives and Fu	inctions of Plai	nt Lavout and	Materia
	•	ortance Types of layouts		•	
-	• •	roduction to CORELAP,	-	-	-
-		and Fixed Position Layou			
-				-	
and bound method Introduction to Material Handling Relationship of material handling to plant layout Methods to minimize cost of material handling Ergonomics of Material Handling equipment.					
9. Learning objectives			equipinent.		
	concept of Workstatio	na			
	-				
	concept Layout constr	-	the de		
		Layout and Analytical M	ethods		
	concept Assessment a	nd Evaluation			
10. Course Outcomes (,				
	he concept of Workst		_		
		E Layout construction tech	-		
	• •	terized Layout and Analyti	cal Methods		
iv) Understanding t	he concept of Assessr	nent and Evaluation			
11. Unit wise detailed c	ontent				
Unit-1	Number of	Title of the unit: Introd	uction and Wo	orkstations	
	lectures = 11	The of the unit. Introd	uction and wo	i KStutions	
Introduction Criteria St		inability and Eco-Efficier	ov in Facility I	Design Basic	Dlanning
	e	es, Location Models, Act	• •		
			Building Detai	is, Aisies and	Security,
Storage Shinning and D	•	chanzeu Aleas.	Worketo	tion Motorial	Uandlina
Storage, Shipping and R	a & Containana Conv	avon Vahialas Lifting D			папания.
Workstations, Unit Load		eyors, Vehicles, Lifting D			-
Workstations, Unit Load Ethics in Facility Design	Facilities design prod	cedure and planning strate	gies, Productior		-
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req	Facilities design produirements and person	cedure and planning strate nel services design conside	gies, Productior rations.	n, activity and	-
Workstations, Unit Load Ethics in Facility Design	Facilities design produirements and person Number of	cedure and planning strate	gies, Productior rations.	n, activity and	-
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2	Facilities design produirements and person Number of lectures = 10	cedure and planning strate nel services design conside Title of the unit: Layou	gies, Productior rations. t construction	n, activity and techniques	materials
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2 Systematic layout plan	Facilities design produirements and person Number of lectures = 10 ning; activity relatio	cedure and planning strate nel services design conside Title of the unit: Layou nship analysis, pair wise	gies, Production rations. t construction exchange, gra	n, activity and techniques aph-based con	materials
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2 Systematic layout plan	Facilities design produirements and person Number of lectures = 10 ning; activity relatio	cedure and planning strate nel services design conside Title of the unit: Layou	gies, Production rations. t construction exchange, gra	n, activity and techniques aph-based con	materials
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2 Systematic layout plan	Facilities design produirements and person Number of lectures = 10 ning; activity relatio	cedure and planning strate nel services design conside Title of the unit: Layou nship analysis, pair wise	gies, Production rations. t construction exchange, gra	n, activity and techniques aph-based con	materials
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2 Systematic layout plan algorithmic. Material Ha	Facilities design produirements and person Number of lectures = 10 ning; activity relatio	cedure and planning strate nel services design conside Title of the unit: Layou nship analysis, pair wise	gies, Production rations. t construction exchange, gra ndling equipmen	n, activity and techniques aph-based con nt and materia	materials
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2 Systematic layout plan algorithmic. Material Ha systems.	Facilities design produirements and personn Number of lectures = 10 ning; activity relatio ndling: Material hand	cedure and planning strate nel services design conside Title of the unit: Layou nship analysis, pair wise ling principles; material ha	gies, Production rations. t construction exchange, gra ndling equipmen	n, activity and techniques aph-based con nt and materia	materials
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2 Systematic layout plan algorithmic. Material Ha systems. Unit – 3	Facilities design pro- uirements and person Number of lectures = 10 ning; activity relatio ndling: Material hand Number of lectures = 10	cedure and planning strate nel services design conside Title of the unit: Layou nship analysis, pair wise ling principles; material hat Title of the unit: Compu	gies, Production rations. t construction exchange, gra ndling equipment aterized Layou	n, activity and techniques aph-based con nt and materia t and Analytic	materials nstruction l handling c al
Workstations, Unit Load Ethics in Facility Design flow analysis, Space req Unit – 2 Systematic layout plan algorithmic. Material Ha systems. Unit – 3 ALDEP, CORELAP, O	Facilities design produirements and personNumber oflectures = 10ning; activity relationdling: Material handNumber oflectures = 10CRAFT, BLOCPLAI	cedure and planning strate nel services design conside Title of the unit: Layou nship analysis, pair wise ling principles; material hat Title of the unit: Compu Methods	gies, Production rations. t construction exchange, gra ndling equipmen aterized Layou ations: function	n, activity and techniques aph-based con nt and materia t and Analytic n, storage o	materials

Unit – 4	Number of	Title of the unit: Assessment and Evaluation				
	lectures = 11					
Assessment and evaluation of layout alternatives Projects, Use Spiral software to practice plant layout design,						
apply mathematic	al and engineering techniqu	es such as systematic layout planning approach, quantitative model,				
cost estimate to s	olve practical facility layout	t problem.				
12. Brief Descrip	otion of self-learning / E-le	arning component				
The students will	be encouraged to learn usin	g the SGT E-Learning portal and choose the relevant lectures				
delivered by subj	ect experts of SGT Universit	ity.				
The link to the E-Learning portal.						
https://sgtlms.org						
Journal papers; P	atents in the respective field	l				

13. Books Recommended

Text Book:

i) Plant Layout and Material Handling, by- S. C. Sharma, Jain Brothers, Khanna Publishers; Third edition, 2000, ISBN: 8174093192

Reference Books:

- i) Plant Layout and Material Handling, by- James M. Apple, John Wiley & Sons, 3rd Edition, ISBN: 0471071714.
- ii) Plant Layout and Material Handling, by- Fred E. Meyers, Prentice Hall. Latest Edition, ISBN: 0130134759
- iii) Facility Layout and Location: An Analytical Approach, by Richard L, Francis, Pearson India, 2nd Edition, ISBN: 0132992310
- iv) Plant Layout and Material Handling, by- B. K. Aggarwal, Jain Brothers, Latest Edition, 2017, ISBN: 8186321780

2.	Name of the Depart	unent- Micchanicai E	Ingineering		
	Course Name	Lean Enterprise	L	Т	Р
		& Advanced			
		Manufacturing			
	<u> </u>	Technologies	2	0	0
	Course Code		3		0
4.	Type of Course (use	e tick mark)	Core ()	PE (✓)	OE ()
5.	Pre-requisite (if		6. Frequency (use	Even Odd	•
_	any)		tick marks)	(✔)	Sem () Sem (
	Total Number of Location $= 42$	ectures, Tutorials, Pi	ractical (assuming 14 wee Tutorials = 0	$\frac{\text{ks of one seme}}{\text{Practical} = 0}$	
			Tutoriais = 0	Practical = 0	•
	Course Description		tampica process re angin	aring and di	gital manufacturing a
			terprise process re-engine gineering and science profe		
		-	ogies, decision-making pro		
	-	-	berience in manufacturing,		-
v		č	This course is deal for wish	0	•
	-	cturing sector and of i		ing to transfer a	smooting and cheetive.
	Learning objectives		industry.		
	ii) To Learn the bas		nking and, enterprise proce ed production techniques methods	•	ing concept.
		-	ols used in various engined	ering application	ons.
10.	Course Outcomes (6	8 11	
	i) To develop lean	thinking and, enterpri	se process re-engineering	concept.	
			iques methods for differen		
	iii) To Evolain Plast	. Due e e e e e un ette e d	a fou different annliestions		
		0	s for different applications		
		0	various engineering applic		
11.		s tools and apply it in			
11. Uni	iv) To Classify Pres	s tools and apply it in		cations.	ka Concept
	iv) To Classify Pres	s tools and apply it in ontent	various engineering applic	ations.	ka Concept
Uni The	iv) To Classify Pres Unit wise detailed c it-1 e mass production	s tools and apply it in content Number of lectures = 10 on system – C	various engineering applic Title of the unit: Introdu (Automation with A Hu Drigin of lean produ	ations. uction & Jidol man Touch) action system	
Uni The reve	 iv) To Classify Pres Unit wise detailed c it-1 mass production olution in Toyota – S 	s tools and apply it in content Number of lectures = 10 on system – Co ystems and systems the	various engineering applic Title of the unit: Introd (Automation with A Hu Drigin of lean produced inking – Basic image of lean	ations. uction & Jidol man Touch) action system an.	m, Necessity, Lea
Uni The revo Pro	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foc 	s tools and apply it in content Number of lectures = 10 on system – O systems and systems the suses Muda (waste). Pe	various engineering applic Title of the unit: Introdu (Automation with A Hu Drigin of lean produ inking – Basic image of le oka concept – Poka-Yoke (ations. uction & Jidol man Touch) uction system an. mistake proofin	m, Necessity, Leanng) systems – Inspectio
Uni The revo Pro	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foc 	s tools and apply it in content Number of lectures = 10 on system – O systems and systems the suses Muda (waste). Pe	various engineering applic Title of the unit: Introd (Automation with A Hu Drigin of lean produced inking – Basic image of lean	ations. uction & Jidol man Touch) uction system an. mistake proofin	m, Necessity, Leanng) systems – Inspectio
Uni The reve Pro	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foc 	s tools and apply it in content Number of lectures = 10 on system – O systems and systems the suses Muda (waste). Pe	various engineering applic Title of the unit: Introdu (Automation with A Hu Drigin of lean produ inking – Basic image of le oka concept – Poka-Yoke (ations. uction & Jidol man Touch) uction system an. mistake proofin	m, Necessity, Leanng) systems – Inspectio
Uni The reve Pro- syst	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foc 	s tools and apply it in content Number of lectures = 10 on system – O systems and systems the suses Muda (waste). Pe	various engineering applic Title of the unit: Introdu (Automation with A Hu Drigin of lean produ inking – Basic image of le oka concept – Poka-Yoke (cations. uction & Jidol man Touch) uction syster an. mistake proofin ementation of J	m, Necessity, Lea ng) systems – Inspectic lidoka.
Uni The revo Pro- syst	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foc tems and zone control 	s tools and apply it in content Number of lectures = 10 on system – O ystems and systems the uses Muda (waste). Per l – Types and use of P	various engineering applic Title of the unit: Introd (Automation with A Hu origin of lean produ- ninking – Basic image of le oka concept – Poka-Yoke (Poke-Yoke systems – Imple	cations. uction & Jidol man Touch) uction syster an. mistake proofin ementation of J	m, Necessity, Lea ng) systems – Inspectic lidoka.
Uni The revo Pro- syst	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foc tems and zone control 	s tools and apply it in content Number of lectures = 10 on system – O ystems and systems the uses Muda (waste). Po 1 – Types and use of P Number of lectures = 10	various engineering applic Title of the unit: Introduce (Automation with A Hu Origin of lean produce Dinking – Basic image of lean Oka concept – Poka-Yoke (Poke-Yoke systems – Imple Title of the unit: Stability	eations. uction & Jidol man Touch) uction system an. mistake proofin ementation of J ty of Lean System ty of Lean System ty of Lean System	m, Necessity, Lea ng) systems – Inspectic lidoka.
Uni The revo Syst Uni	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foc tems and zone control it – 2 	s tools and apply it in content Number of lectures = 10 on system – O ystems and systems the cuses Muda (waste). Per l – Types and use of F Number of lectures = 10 c lean system	various engineering applicTitle of the unit: Introduct(Automation with A HuOriginofleanproductpriginofleanproductoka concept – Poka-Yoke (Poke-Yoke systems – ImpleTitle of the unit: Stability,5Ssystem,	eations. uction & Jidol man Touch) uction system an. mistake proofin ementation of J ty of Lean System ty of Lean System ty of Lean System	m, Necessity, Lea ng) systems – Inspectic lidoka. s tem & Just In Time
Uni The revo Syst Uni	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foct tems and zone control it – 2 ndards in the ndardized work, 	s tools and apply it in content Number of lectures = 10 on system – O ystems and systems the cuses Muda (waste). Per l – Types and use of F Number of lectures = 10 c lean system	various engineering applic Title of the unit: Introduction with A Hurbergin of lean production of lean producting of lean producting of lean production of lean production of le	cations. uction & Jidol man Touch) uction system an. mistake proofin ementation of J ty of Lean Sys Total Prode	m, Necessity, Lea ng) systems – Inspectio fidoka. stem & Just In Time uctive Maintenand
Uni The revo Syst Uni Star star wor	 iv) To Classify Pres Unit wise detailed of the second second	s tools and apply it in content Number of lectures = 10 on system – O ystems and systems the ruses Muda (waste). Per 1 – Types and use of F Number of lectures = 10 c lean system Elements of s reduction, Overa	various engineering applic Title of the unit: Introduction with A Hurbergin of lean production of lean producting of lean producting of lean production of lean production of le	cations. uction & Jidol man Touch) uction system an. mistake proofing ementation of J ty of Lean System Total Production Charts to standardized	m, Necessity, Lea ng) systems – Inspectio fidoka. stem & Just In Time uctive Maintenance define standardize work and Kaize
Unit The revo Pro syst Unit Stan star wor &la	iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foct tems and zone control it – 2 it – 2 indards in the ndardized work, rk, Man power ayouts. Principles	s tools and apply it in content Number of lectures = 10 on system – O ystems and systems the cuses Muda (waste). Per l – Types and use of F Number of lectures = 10 e lean system Elements of so reduction, Overa of JIT – JIT system	various engineering applic Title of the unit: Introdu (Automation with A Hu Origin of lean produ oinking – Basic image of le oka concept – Poka-Yoke (Poke-Yoke systems – Imple Title of the unit: Stability , 5S system, 7 standardized work, 6 ull efficiency, and	cations. uction & Jidol man Touch) action system an. mistake proofine ementation of J ty of Lean System Total Production Charts to standardized nban rules	m, Necessity, Lea ng) systems – Inspectio fidoka. stem & Just In Time uctive Maintenance define standardize work and Kaize
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Unit The revo Pro syst Unit Star star won &laa con	 iv) To Classify Pres Unit wise detailed c it-1 e mass production olution in Toyota – S duction Customer foct tems and zone control it – 2 it – 3 it – 4 it – 4 it – 4 it – 4 it – 5 it – 6 it – 7 it – 9 it – 9 it – 10 it	s tools and apply it in Number of lectures = 10 On system – O ystems and systems the uses Muda (waste). Per I – Types and use of F Number of lectures = 10 e lean system Elements of served reduction, Overation of JIT – JIT system I – Pull system	various engineering applic Title of the unit: Introdu (Automation with A Hu Origin of lean produ ninking – Basic image of le oka concept – Poka-Yoke (Poke-Yoke systems – Imple Title of the unit: Stability , 5S system, 7 standardized work, 6 all efficiency, and stem – Kanban – Ka ms – Value stream mappin	cations. uction & Jidol man Touch) uction system an. mistake proofine ementation of J by of Lean System Total Production Charts to standardized nban rules g.	m, Necessity, Lea ng) systems – Inspectio fidoka. Stem & Just In Time uctive Maintenance define standardize work and Kaize – Expanded role o

moulding, Extruding, Casting, Calendaring, machining and welding, fabrication methods. Applications of Plastics. Shear action in die cutting operation, punch and die clearance and angular clearance, centre of pressure, cutting forces. Press working operations: blanking, piercing and forming, lancing, cutting-off and parting, notching, shaving, trimming, embossing, beading and curling, bulging, twisting, coining, swaging, hole flanging or extruding, line sketches and meaning of terms.

Unit – 4	Number of	Title of the unit: Press Tools Introduction
	lectures = 12	

Press Tools Introduction, Types of Presses, hand, power, gap, inclinable, adjustable, horn, straight side, and pillar presses. Constructional details of a power press, Press size. Press Tools, Punch and die, Die Accessories, Stops, Pilots, strippers, Knockouts, pressure pads. Shear action in die cutting operation punch and die clearance and angular clearance, centre of pressure, cutting forces.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

i) Manufacturing Technology - Vol.1 Paperback by P.N Rae, ISBN-10: 9353160502, Publisher McGraw Hill Education (24 July 2018)

Reference Books:

- Lean Manufacturing: Tools, Techniques, and How to Use Them (Resource Management) Hardcover 28 September 2000 by William M Feld, ISBN-13: 978-1574442977.
- ii) Industrial Engineering & Operations management by S. K. Sharma & Savita Sharma, Kataria publishers ISBN: 1412918057
- iii) Handbook of Engineering Management- Edited by Dennis Lock, Butterwork & Heinemanky Ltd., ISBN: 0470942185
 - iv) Lean Manufacturing and Tools Paperback by Shorya Sharma, ISBN-13: 978-1647831806, Publisher: Notion Press (18 December 2019)

2.	Course Name	Mechanical Vibration		L	Т		Р	
3.	Course Code			3	0		0	
4.	Type of Cour	se (use tick mark)		Core ()	PE (1	/)	OE ()	
5.	Pre- requisite (if any)	KOM & DOM	6.	Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Numbe	r of Lectures, Tutori	als, P	ractical (assum	ning 14 wee	ks of one s	emester)	
	Lectures = 42	2	Tut	orials = 0	Prac	tical = 00		

8. Course Description

A structure or a body is said to vibrate if it has a to and fro motion. A greater proportion of human activities involve vibration in one form or the other. We hear because our eardrums vibrate. The cause and effects of vibration must be clearly understood. The structures designed to support the high speed machines are subjected to inherent unbalance which causes problems. The unbalance may be due to faulty design or poor manufacture. Because of cyclic vibration, the material of the structure or the machine component may undergo fatigue failure. Vibration causes fasteners such as nuts of the machine to become loose. In metal machining processes, vibration may cause chatter, which results in poor surface finish. If the natural frequency of vibration of a machine or structure equals the forced frequency caused by external excitation, resonance occurs which causes dangerously large oscillations and the structure fails. A bridge can collapse due to wind-induced vibration. Critical instruments mounted on machines may loose their accuracy due to excessive vibrations. Vibrations can be used for useful works such as vibration testing equipments, vibratory conveyors, hoppers, sieves, compactors, washing machines.

9. Learning objectives:

- i) To learn the basics of vibrations including causes and effects of vibrations.
- ii) To study the undamped and damped free vibration.
- iii) To study the forced vibrations.

iv) To study multi degrees of freedom system and vibration measuring instruments..

10. Course Outcomes (COs):

- i) Understanding the fundamentals concepts of vibration.
- ii) To understand the free and forced vibrations with two-degree freedom system.
- iii) To learn the methods to solve vibration problems with multi-degree freedom system.
- iv) To understand the basics of vibration of continuous systems and experimental methods in vibration analysis and the working of vibration measuring instruments.

11. Unit wise detailed content				
Unit-1 Number of		Title of the unit: Fundamentals of Vibrations		
	lectures = 10			
Terminology, Sin	gle degree freedom sys	tems – Response to arbitrary periodic excitations – Duhamel's integral		

		vork – Lagrange's equation – Single degree freedom forced vibration
		s – System identification from frequency response – Transient vibration
<u> </u>	ormation formulation.	
Unit – 2	Number of	Title of the unit: Two Degree Freedom System
	lectures = 10	
		- Mass coupled system - Bending vibrations of two degree freedom
	vibration – Vibration	Absorber - Vibration Isolation. Force Transmissibility and Support
Motion.		
Unit – 3	Number of	Title of the unit: Multi Degree Freedom System
	lectures = 10	
		ty matrix and Stiffness matrix – Eigen value and Eigen vector –
		- Modal analysis - Forced vibration by matrix inversion - Moda
Unit – 4	Number of	I methods for fundamental frequencies. Title of the unit: Vibration of continuous Systems and
01111 – 4	lectures = 12	Experimental Methods in Vibration Analysis
System governed		Vibration of strings – Vibration of rods – Euler's equation for beams –
• •	• •	mation – Vibration of plates.
•	mertia and shear deror	
Vibration Measu	ring Instruments – Vib	•
	-	ration Exciters - Vibration Tests - Free and Forced Vibration Tests
Examples of Vib 12. Brief Descrip	ration Tests – Industria otion of self-learning /	ration Exciters – Vibration Tests – Free and Forced Vibration Tests l Case Studies, Current industry trends E-learning component
Examples of Vib 12. Brief Descrip The students will b delivered by subject The link to the E-L <u>https://sgtlms.org</u>	ration Tests – Industria otion of self-learning / be encouraged to learn u ct experts of SGT Univ	 bration Exciters – Vibration Tests – Free and Forced Vibration Tests <u>1 Case Studies</u>, Current industry trends E-learning component using the SGT E-Learning portal and choose the relevant lectures ersity.
Examples of Vib 12. Brief Descrip The students will b delivered by subject The link to the E-L https://sgtlms.org	ration Tests – Industria otion of self-learning / be encouraged to learn u ct experts of SGT Univ Learning portal.	 bration Exciters – Vibration Tests – Free and Forced Vibration Tests <u>1 Case Studies</u>, Current industry trends E-learning component using the SGT E-Learning portal and choose the relevant lectures ersity.
Examples of Vib 12. Brief Descrip The students will b delivered by subject The link to the E-L <u>https://sgtlms.org</u> Journal papers; Par	ration Tests – Industria otion of self-learning / be encouraged to learn u ct experts of SGT Univ learning portal. tents in the respective f	 bration Exciters – Vibration Tests – Free and Forced Vibration Tests <u>1 Case Studies</u>, Current industry trends E-learning component using the SGT E-Learning portal and choose the relevant lectures ersity.
Examples of Vib 12. Brief Descrip The students will b delivered by subject The link to the E-L https://sgtlms.org Journal papers; Part 13. Books Recon Textbook Boo i) William T	ration Tests – Industria otion of self-learning / be encouraged to learn u ct experts of SGT Univ Learning portal. tents in the respective f mmended k	ration Exciters – Vibration Tests – Free and Forced Vibration Tests I Case Studies, Current industry trends E-learning component using the SGT E-Learning portal and choose the relevant lectures ersity. ield. eory of vibration with applications, 5 th Edition, Pearson
Examples of Vib 12. Brief Descrip The students will b delivered by subject The link to the E-L https://sgtlms.org Journal papers; Part 13. Books Recon Textbook Boo i) William T	ration Tests – Industria otion of self-learning / be encouraged to learn u ct experts of SGT Univ learning portal. tents in the respective f mmended k C. Thomson (2005), Th India. ISBN: 978-8-13	ration Exciters – Vibration Tests – Free and Forced Vibration Tests I Case Studies, Current industry trends E-learning component using the SGT E-Learning portal and choose the relevant lectures ersity. ield. eory of vibration with applications, 5 th Edition, Pearson
Examples of Vib 12. Brief Descrip The students will b delivered by subject The link to the E-L https://sgtlms.org Journal papers; Pat 13. Books Recon Textbook Boo i) William T Education Reference Boo	ration Tests – Industria otion of self-learning / be encouraged to learn u ct experts of SGT Univ Learning portal. tents in the respective f mended k T. Thomson (2005), Th India. ISBN: 978-8-13 oks	ration Exciters – Vibration Tests – Free and Forced Vibration Tests I Case Studies, Current industry trends E-learning component using the SGT E-Learning portal and choose the relevant lectures ersity. ield. eory of vibration with applications, 5 th Edition, Pearson
Examples of Vib 12. Brief Descrip The students will b delivered by subject The link to the E-L https://sgtlms.org Journal papers; Pat 13. Books Recon Textbook Boo i) William T Education Reference Boo i) R V Dukk	ration Tests – Industria otion of self-learning / be encouraged to learn u ct experts of SGT Univ Learning portal. tents in the respective f mended k C. Thomson (2005), Th India. ISBN: 978-8-13 oks ipati (2008), Advanced	ration Exciters – Vibration Tests – Free and Forced Vibration Tests 1 Case Studies, Current industry trends E-learning component using the SGT E-Learning portal and choose the relevant lectures ersity. ield. eory of vibration with applications, 5 th Edition, Pearson 1-70482-0.

1.	Name of the Den	artment- Mechanica	l Engineering				
2.	Course Name	Nano Materials	L	Т		Р	
3.	Course Code		3	0		0	
4.	Type of Course (use tick mark)	Core ()	PE	OE ()	BSC ()	EAS ()
т.	Type of Course (use tiek mark)		(✓)	OL ()	bbe ()	
				(,)			
5.	Pre-requisite (if	MET	6. Frequency	Even	Odd ()	Fither Sem	Every Sem ()
	any)		(use tick	(✓)	ouu ()	()	Livery Sem ()
	ung)		marks)				
7.	Total Number of	Lectures, Tutorials		ing 14	weeks of	one semester	
	ctures = 42		Tutorials = 0		ical = 0	~)	
	Course Descripti	on					
	-	romechanical machin	es (NEM and ME	M) are	manufact	ured in the bil	lions annually
		rinting, automotive a					
ME	EMS promise to rev	volutionize biotechno	logy and biomedic	al engi	neering the	rough fabricat	ion of devices
unc	ler 100 micrometer	s using novel micro a	nd Nano-fabricatio	on techr	iques. Na	nofabrication	is the group of
	A	scientists and enginee					
		tion consists of carvi					
		ams of electrons or id					
		tomic layers one at a ti	ime by deposition	or by m	olecular or	nanoparticle	self-assembly.
9.	Learning objecti						
		l the basic concepts o					
		e knowledge of nonn					
		with the properties of			pplication	s.	
10		the mechanical prop					
10.		s (COs): On complet			lents will	be able to	
		erials for various indu	* *				
		IEMS / NEMS device		cations	•		
		aches for Nanomater			oution		
11	Unit wise detaile	Nanostructures on the		ai piop	erties.		
Un		Number of	Title of the unit	• Intro	duction to	Nanotechnol	ogy
UI		lectures $= 10$	The of the unit	. 1111 0			logy
Na		kground and definition	n of nanotechnolo	ov Tvi	nes of Nai	no materials N	ficrostructure
		n in different fields, F					nerostructure,
	* **	imber of lectures =	Title of the unit			no materials	
011	11			, synth			
Ch		as phase synthesis, Li	auid phase synthe	sis Plas	ma vapor	deposition Sr	orav synthesis
		AP, Characterization,					
TE		, спатастеленной,	2 comption of the				
		mber of lectures =	Title of the unit	Types	of Nano	materials	
011				5 PC5			
Me		es, Metallic alloys, N	Nano wires and ro	ds, thin	films. Ca	arbon Nanotul	bes, Structure.
		echanisms, Propertie					
-		Applications, Polymer	~ ~		-		
		hy and third dimensio					
		mber of lectures =		-	<u> </u>		nostructures
Me		tion of Nano phase n	naterials- Creen in	Nano r	naterials.	Experimental	techniaues for
me	-	hanical properties of	-			-	-
		of self-learning / E-	learning compon	ent			
14.	DIG DESCIPTION	i or sen lear inng / E-	icar ning compon	ciit			

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Textbook:

i) Charles P. Poole and Frank J. Owens (2007), Introduction to Nanotechnology, John Wiley & Sons. ISBN: 978-8-126-51099-3.

Refere	nce Books:
i)	Jin Zhang, Zhong-lin Wang, Jun Liu, Shaowei Chen and Gang-yu Liu, (2003), Self Assembled
	Nanostructures, Kluwer Academic/Plenum Publishers. ISBN: 978-0-306-47299-2.
ii)	Bharat Bhushan (2007), Hand book of Nanotechnology, Springer Hand Book. ISBN: 978-3-540-
	29855-7.
iii)	Mark Ratner and Daniel Ratner (2009), Nanotechnology: A Gentle Introduction to the Next Big
	Idea, 5th Edition, Pearson Education India. ISBN: 978-8-177-58743-2.

Department Electives-IV

4. Type of Course (use tick mark) Core () PE (✓) OE () 5. Pre-requisite Fluid Mechanics and Fluid 6. Frequency (Use tick marks) Even (✓) Odd () Either Ever Sem () Sem ()	2. Course Name	Fluid Power	L	r	Г		Р
4. Type of Course (use tick mark) Core () PE (✓) OE () 5. Pre-requisite Fluid Mechanics and Fluid 6. Frequency (Use tick marks) Even (✓) Odd () Either Sem () Sem Sem 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Tutorials = 0 Practical = 0 8. Course Description: A fluid power system has a pump driven by a prime mover (such as an electric motor or IC engine) that converse mechanical energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Pneumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. 9. Learning Objectives: i) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) To learn sudents about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power maintenance and troubleshooting. iii) Gets exposure to the basics of fluid flow including the physical laws affecting fluid standards and symbols used in industrial applications. iii) Giain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Gain knowledge of the tornes = 12 Title of the unit: Introduction to Fluid Power Definition- Hydraulics Vs Pneumatics – Standards- Application – Basic Principle of Hydraulics-Pascal's La Transmission and multiplication of force-Basic properties of hydraulic and Pneumatic Pow		System					
5. Pre-requisite Fluid Mechanics and Fluid Machinery 6. Frequency (Use tick marks) Even (✓) Odd () Either Sem () Sem () 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Intorials = 0 Practical = 0 8. Course Description: A fluid power system has a pump driven by a prime mover (such as an electric motor or IC engine) that conve mechanical energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Pneumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. 9. Learning Objectives: i) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) To learn students about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power maintenance and troubleshooting. 10. Course Outcomes (COs): At the end of this course, the learner will be: i) Find the importance of fluid power technology in industries and to obtain knowledge on hydraulic and pneumatic components. iii) Gain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Gain knowledge of that how to control the Hydraulic and Pneumatic fluids- liquid flow- static head pressu pressure loss – Power-Basic principle of pneumatics: absolute pressure and Temperature- gas laws	3. Course Code		3		0		0
and Fluid Machinery (Use tick marks) Sem ()	4. Type of Course	(use tick mark)	Core ()	PE (✔)		OE ()	
Machinery Coro and matching 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Lectures = 42 Tutorials = 0 8. Course Description: A fluid power system has a pump driven by a prime mover (such as an electric motor or IC engine) that convence necchaincal energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Pneumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. 9. Learning Objectives: i) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) To learn students about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power technology in industries and to obtain knowledge on hydraulic and pneumatic components. iii) Gets exposure to the basics of fluid flow including the physical laws affecting fluid standards and symbols used in industrial applications. iv) Gain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Gain knowledge of the various components in fluid power industry and solve problems related to pump 11. Unit wise detailed content Umit-1 Number of lectures = 12 Title of the unit: Introduction to Fluid Power Definition- Hydraulics Vs Pneumatics – Standards- Appl	5. Pre-requisite		6. Frequency	Even (🗸)	Odd ()	Either	Every
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) Lectures = 42 Tutorials = 0 Practical = 0 8. Course Description: A fluid power system has a pump driven by a prime mover (such as an electric motor or IC engine) that convene chanical energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Preumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. 9. Learning Objectives: i) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) To learn students about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power maintenance and troubleshooting. 10. Course Outcomes (COs): At the end of this course, the learner will be: i) Find the importance of fluid power technology in industries and to obtain knowledge on hydraulic and pneumatic components. iii) Gets exposure to the basics of fluid flow including the physical laws affecting fluid standards and symbols used in industrial applications. iv) Gain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Gain knowledge of the various components in fluid power industry and solve problems related to pump 11. Unit wise detailed content Unit 1 Number of lectures = 12			(Use tick marks)			Sem ()	Sem (
Tutorials = 0 Practical = 0 S. Course Description: A fluid power system has a pump driven by a prime mover (such as an electric motor or IC engine) that convene chanical energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Pneumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. 9. Learning Objectives: i) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) Inderstanding of basics of hydraulic and Pneumatic systems. iii) iv) To learn students about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power maintenance and troubleshooting. 10. Course Outcomes (COs): At the end of this course, the learner will be: i) Find the importance of fluid power technology in industries and to obtain knowledge on hydraulic and pneumatic components. iii) Gain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Gain knowledge of the various components in fluid power industry and solve problems related to pump 11. Unit wise detailed content Inter of lectures = 12 Title of the unit: Introduction to Fluid Power Unit-1 Number of lectures = 12 Title of the u							
S. Course Description: A fluid power system has a pump driven by a prime mover (such as an electric motor or IC engine) that convene chanical energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Preumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. 9. Learning Objectives: i) ii) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) To learn students about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power maintenance and troubleshooting. (0. Course Outcomes (COS): At the end of this course, the learner will be: i) Find the importance of fluid power technology in industries and to obtain knowledge on hydraulic and pneumatic components. iii) Gain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Gain knowledge of the various components in fluid power industry and solve problems related to pump L1. Unit wise detailed content Unit-1 Number of lectures = 12 Title of the unit: Introduction to Fluid Power Definition- Hydraulics Vs Pneumatics – Standards- Application – Basic Principle of Hydraulics-Pascal's La fransmission and multiplication of force-Basic properties of hydraulic fluids- liquid flow - static head pressu pressure loss – Power-Basic principle of pneumatics: absolute pressure and Temperature- gas laws- vacuum. Unit - 2		of Lectures, Tutorials,	_			·)	
A fluid power system has a pump driven by a prime mover (such as an electric motor or IC engine) that convencehanical energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Pneumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. P. Learning Objectives: i) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) To learn students about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power maintenance and troubleshooting. 10. Course Outcomes (COs): At the end of this course, the learner will be: i) Find the importance of fluid power technology in industries and to obtain knowledge on hydraulic and pneumatic components. ii) Gets exposure to the basics of fluid flow including the physical laws affecting fluid standards and symbols used in industrial applications. iii) Gain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Number of lectures = 12 Title of the unit: Introduction to Fluid Power Definition- Hydraulics Vs Pneumatics – Standards- Application – Basic Principle of Hydraulics-Pascal's La Transmission and multiplication of force-Basic properties of hydrauli fluids- liquid flow- static head pressu pressure loss – Power-Basic principle of pneumatics: absolute pressure and Temperature- gas laws - vacuum.			Tutorials = 0	Pract	ical = 0		
mechanical energy into fluid energy. This fluid flow is used to actuate a device such as: A Hydraulic cylinder Pneumatic cylinder, A Hydraulic motor or Pneumatic motor, A Rotary actuator etc. 9. Learning Objectives: i) Understanding of basics of hydraulics and pneumatics (pumps and various power supply sources). ii) To learn students about the utilization of cylinders, accumulators, valves and various control components. iii) Understand the control of Hydraulic and Pneumatic systems. iv) To learn about fluid power maintenance and troubleshooting. 10. Course Outcomes (COs): At the end of this course, the learner will be: i) Find the importance of fluid power technology in industries and to obtain knowledge on hydraulic and pneumatic components. ii) Gets exposure to the basics of fluid flow including the physical laws affecting fluid standards and symbols used in industrial applications. iii) Gain knowledge of that how to control the Hydraulic and Pneumatic Systems. iv) Gain knowledge of the various components in fluid power industry and solve problems related to pump 11. Unit wise detailed content Unit-1 Number of lectures = 12 Title of the unit: Introduction to Fluid Power Definition- Hydraulics Vs Pneumatics – Standards- Application – Basic Principle of Hydraulics-Pascal's La Transmission and multiplication of force-Basic properties of hydraulic fluids- liquid flow-static head pressu pressure loss – Power-Basic principle of pneumatics: absolute pressure and Tempera	3. Course Descrip	tion:					
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Parts - Gases in Hydraulic Fluids - Temperature Control - Troubleshooting.	pneumatic coii) Gets exposure symbols usediii) Gain knowlediii) Gain knowlediv) Gain knowled11. Unit wise detailUnit-1NumbDefinition- HydrauliTransmission and m pressure loss – PoweUnit – 2NumbHydraulic Pump- gr efficiency –air compUnit – 3NumbCylinders-accumular electronic control coUnit – 4Numb	mponents. to the basics of fluid fliin industrial application ge of that how to contro- ge of the various completed content per of lectures = 12 its Vs Pneumatics – St ultiplication of force-B er-Basic principle of pri- per of lectures = 10 aphic symbol- pump typeressor- graphic symbol- per of lectures = 9 tors –FRL-Directional opponents- symbols. per of lectures = 11 g Devices - Reservoir S	ow including the physic is. ol the Hydraulic and Pne- onents in fluid power ind Title of the unit: In andards- Application – I asic properties of hydrate eumatics: absolute press Title of the unit: H Source pes -pump flow and pre- compressor types-comp Title of the unit: H Components control Valves- Press Title of the unit: B Maintenance ystem - Filters and Strain	and to obtain al laws affec cumatic Syste dustry and so htroduction Basic Princip ulic fluids- li gure and Tem ydraulic an essure- pump pressor sizing ydraulic an sure control asic Circuit ners - Beta R	ting fluid sta ems. olve problem to Fluid Pov ole of Hydrau quid flow- s operature- ga d Pneumation o drive torque g- vacuum p nd Pneumation valves-Flow s, Fluid Pow	andards an s related to wer ulics-Pasc tatic head as laws- va c Power S e and Pow umps. ic Control w control	o pump al's La pressur cuum. Supply /er- pur l Valve n

12. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

i) lango and Sundararajan (2017), Introduction to Hydraulics and Pneumatics, 3rd Edition, Prentice hall, ISBN: 978-81-203-4406-8.

Reference Books:

i)	M. Rabie (2009),	Fluid power Engineer	ing, McGraw-Hill,	, NY, ISBN: 978-	-0-071-62246-2.
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ii) Espositho (2009), Fluid power with application, 6th edition, Prentice Hall, ISBN: 978-81-7758-580-3.
iii) Robert P. Kokernak (1999), Fluid power technology, 2nd edition, Prentice Hall, ISBN: 978-0-139-12487-7.

1.	Name of the De	epartment- Mechanical	Engineering					
2.	2. Course Name CNC Programming			L		Т	Р	
3.	Course Code			3		0	()
4.	Type of Course	e (use tick mark)	Core ()	EAS ()	PE (✓))	OE ()	
5.	Pre-requisite (if any)	Advance Machining Process	6. Frequent marks)	cy (use tick	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Lee	Total Number of the second sec	of Lectures, Tutorials,	 Practical (assu Tutorials = (8	s of one se			
The	e theoretical cond	tion: uctory Learn Standard te cepts of Automatic/ Con 1 environment using pro	nputer Assisted	NC Tool Path	Planning 1	for multi	-axis mac	hines as
cor	structional detail	ls of NC machine tools, ctivity enhancement.		•		•		

9. Learning objective

- i) To understand the concept of CNC Programming effectively.
- ii) To understand the concept of CNC machine tools & application.
- iii) To understand the concept of CNC technology using part programming.
- iv) To understand the concept of computer aided part programming.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Practice CNC Programming effectively.
- ii) Acquire knowledge and use simple CNC machine tools & application.
- iii) To understand fundamentals of the CNC technology using part programming.
- iv) To understand the computer aided part programming.

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Title of the unit: Introduction
Basics and need of C	CNC machines, NC, CNC	C and DNC systems, Structure of NC systems, Applications of CNC

Basics and need of CNC machines, NC, CNC and DNC systems, Structure of NC systems, Applications of CNC machines in manufacturing, Advantages of CNC machines.

Unit – 2	Number of	Title of the unit: CNC Machine & tooling
	lectures = 12	

Machine structure, Slide –ways, Motion transmission elements, Swarf removal and safety considerations, Automatic tool changers and multiple pallet systems, Sensors and feedback devices in CNC machines, Constructional detail of CNC turning center and CNC machining center, Classification of CNC control systems. Tooling requirements of CNC machines, Pre-set and qualified tools, Work and tool holding devices in CNC machines.

Unit – 3	Number of lectures	Title of the unit: Part Programming
	= 10	

Axis identification and coordinate systems, Structure of CNC part program, Programming codes ,Programming for 2 and 3 axis control systems ,Manual part programming for a turning center ,Programming using tool nose radius compensation ,Tools offsets ,Do loops, sub routines and fixed cycles.

Unit – 4	Number of lectures =	Title of the unit: Computer Aided CNC Part Programming
	10	

Need for computer aided part programming, Tools for computer aided part programming, APT, COMPACT II, CAD/CAM based part programming.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Kundra, Rao and Tewari, "Numerical Control and Computer Aided Manufacturing" Tata McGraw-Hill, New Delhi, ISBN-9780074517345, 0074517341

Reference Books

- i) Ploywka, John & Gabrel, Stanley, "Programming of Computer Numerically Controlled Machines" Industrial Press Inc., New York, 1992, ISBN: 0831130350
 ii) Deally Computer Numerically Controlled Machines"
 - ii) Rapello. Ralph. "Essentials of Numerical Control", Prentice Hall, NJ, 1986, ISBN: 978-0132865685

	Name of the						
	Course	Chassis Design	L		Т		Р
	Name	_		0 0			
3.	Course		3			0	
	Code						
4.	Type of Cou	rse (use tick	Core ()	PE (✔)	OE	MS ()	
	mark)				0		
5.	Pre-	Advance	6. Frequency	Even (✔)	Odd ()	Either Sem	Every Ser
	requisite	Graphics	(use tick		~	0	0
	(if any)	Design	marks)				
		Design					
7.			orials, Practical (ass			semester)	
	Lectures = 4	2	Tutorials = 0	Practi	cal = 0		
	~ ~	•					
8.	Course Desc	-					
		•	he opportunity to exp	-	-		-
	-		process. You will als	o learn about	clutch, gear	r box, suspens	ion, steerin
and	frame system	S.					
	ii) Understar	nd the complete desi	gn exercise and arrive	e at important	dimensions	of chassis cor	nponents.
10. 11. Uı	 iii) Understar iv) Understar course Oute i) The stude ii) Design th iii) Design th iii) Design th iv) Analyze t Unit wise de 	ad the Clutch Design ad the Gear Box Descomes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11	h. the completion of the rent areas of automote ering system of an autor power transmission. intenance of Gear bo Title of the unit: N	e course, the s bile chassis co tomobile. x of an autom	tudent shall omponent de nobile. ne and Susp	be able to sign. ension	
10. 11. Un	 iii) Understar iv) Understar course Outo i) The stude ii) Design th iii) Design th iv) Analyze t Unit wise de nit-1 	ad the Clutch Design ad the Gear Box Descomes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11	n. bign. the completion of the rent areas of automobe ering system of an autor power transmission. intenance of Gear bo	e course, the s bile chassis co tomobile. x of an autom Vehicle Fram esign of frame	tudent shall omponent de nobile. ne and Susp	be able to sign. ension	
10. 11. Un Stud – D	 iii) Understar iv) Understar course Outo i) The stude ii) Design th iii) Design th iv) Analyze t Unit wise de nit-1 	ad the Clutch Design ad the Gear Box Descomes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11	h. the completion of the rent areas of automotering system of an autor power transmission. intenance of Gear bo Title of the unit: Note the the the the the the the the the t	e course, the soile chassis contomobile. x of an automobile. Vehicle Fram esign of frame	tudent shall omponent de nobile. Ie and Susp e for passen	be able to sign. ension ger and comme	
10. 11. Ur Stuc – D	 iii) Understar iv) Understar iv) Understar course Outo i) The stude ii) Design th iii) Design th iv) Analyze t Unit wise de mit-1 	ad the Clutch Design ad the Gear Box Des comes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11 oments and stresses of prings-Coil springs Number of lectures = 10	h. sign. the completion of the rent areas of automobering power transmission. intenance of Gear bo Title of the unit: No on frame members. D and torsion bar spring	e course, the soile chassis contomobile. x of an automobile. Vehicle Fram esign of frame gs. ront Axle an	tudent shall omponent de nobile. e and Susp e for passen d Steering S	be able to sign. ension ger and comme Systems	ercial vehicl
10. 11. U1 Stud - D U1 Ana	 iii) Understar iv) Understar iv) Understar course Outo i) The stude ii) Design th iii) Design th iii) Design th iv) Analyze t Unit wise de nit-1 	ad the Clutch Design ad the Gear Box Des comes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11 oments and stresses of prings-Coil springs Number of lectures = 10 -moments and stres	h. sign. the completion of the rent areas of automobering system of an autor power transmission. intenance of Gear bo Title of the unit: Note on frame members. D and torsion bar spring Title of the unit: F	e course, the soile chassis contomobile. x of an autom /ehicle Fram esign of frame gs. ront Axle an	tudent shall omponent de nobile. e and Suspe e for passen d Steering S	be able to sign. ension ger and comme Systems ination of bea	ercial vehicl
10. 11. U1 Stud – D U1 Ana Kin	 iii) Understar iv) Understar iv) Understar course Outo i) The stude ii) Design th iii) Design th iv) Analyze t Unit wise de nit-1 	ad the Clutch Design ad the Gear Box Des comes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11 oments and stresses of prings-Coil springs Number of lectures = 10 -moments and stress.	h. sign. the completion of the rent areas of automobering system of an autor power transmission. intenance of Gear bo Title of the unit: V on frame members. D and torsion bar spring Title of the unit: F ses at different section	e course, the soile chassis contomobile. x of an automobile. Vehicle Fram esign of frame gs. ront Axle an ons of front a earings. Deter	tudent shall mponent de obile. e and Susp e for passen d Steering S xle. Determ mination of	be able to sign. ension ger and comme Systems ination of bea optimum din	ercial vehicl
10. 11. Un Stud – D Un Ana Kin prop	 iii) Understar iv) Understar iv) Understar course Outo i) The stude ii) Design th iii) Design th iii) Design th iv) Analyze t Unit wise de nit-1 	ad the Clutch Design ad the Gear Box Des comes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11 oments and stresses of prings-Coil springs Number of lectures = 10 -moments and stress Wheel spindle bea erring linkages, ensu	h. sign. the completion of the rent areas of automobering system of an autor power transmission. intenance of Gear bo Title of the unit: V on frame members. D and torsion bar spring Title of the unit: F ses at different section arings. Choice of Be pring minimum error	e course, the soile chassis contomobile. x of an automobile. Vehicle Fram esign of frame gs. ront Axle an ons of front a earings. Deter in steering. D	tudent shall mponent de obile. e and Susp e for passen d Steering S xle. Determ mination of	be able to sign. ension ger and comme Systems ination of bea optimum din	ercial vehicl
10. 11. Un Stud – D Un Ana Kin prop	 iii) Understar iv) Understar iv) Understar course Outo i) The stude ii) Design th iii) Design th iv) Analyze t Unit wise de nit-1 	ad the Clutch Design ad the Gear Box Des comes (COs): After nt can identify diffe e front axle and Stee e clutch for flawless he assembly and ma tailed content Number of lectures = 11 oments and stresses of prings-Coil springs Number of lectures = 10 -moments and stress.	h. sign. the completion of the rent areas of automobering system of an autoristic power transmission. intenance of Gear bo Title of the unit: V on frame members. D and torsion bar spring Title of the unit: F ses at different section arings. Choice of Be	e course, the soile chassis contomobile. x of an automobile. Vehicle Fram esign of frame gs. ront Axle an ons of front a earings. Deter in steering. D	tudent shall mponent de obile. e and Susp e for passen d Steering S xle. Determ mination of	be able to sign. ension ger and comme Systems ination of bea optimum din	ercial vehicl

Unit – 4	Number of	Title of the Unit: Gearbox design
	lectures = 10	
Basic considerat	ion in design, det	termination of speed range, concept of structure diagram, graphical
representation of	Ray and speed diag	ram, gearbox layout.
	-	ng / E-learning component
The students will	be encouraged to le	arn using the SGT E-Learning portal and choose the relevant lectures
delivered by subj	ect experts of SGT U	University.
The link to the E-	Learning portal.	
https://sgtlms.org		
<u>intps://sgtims.org</u>	1	
Journal papers; P	atents in the respect	ive field.
I I I I		
13. Books Reco	mmended	
Text Book:		
i) Machine	Design by R. S. Kh	urmi & J.K.Gupta, S.Chand & Co
Reference Books	5:	
i) Dean Av	erns, "Automobile C	Chassis Design", Illife Book Co., 2001.
ii) Design o	f machine Elements	by Bhandari, Tata McGraw-Hill Publishing Company Ltd
iii) Machine	Design by Sharma-	Agarwal, S.K.Kataria & Sons

iv) Machine Design by Sadhusingh, Khanna Publishers,

1. Name of the Depar	tment- Mechanical F	Ingineering				
2. Course Name	Work Study	L	Т	I]	Р
3. Course Code		3	0 ()	
4. Type of Course (us	e tick mark)	Core ()	PE (✔)		OE ()	
5. Pre-requisite (if	Industrial	6. Frequency (use	Even	Odd ()	Either	Every
any)	Engineering	tick marks)	(✔)		Sem ()	Sem ()
7. Total Number of L	ectures, Tutorials, P	ractical (assuming 14 wee	ks of one s	semester))	
Lectures = 42		Tutorials = 0	Practical	= 0		
8. Course Description						
This is a course based	on Work study and in	dustrial engineering play in	mportant ro	ole in job	simplific	ation, job
	• •	ering, method analysis, op		•		•
		. Industrial engineering is				-
	-	ent and setting up of engi	neering sys	stems end	compassir	ng plants,
machinery, workers, etc.						
9. Learning objectives						
	· ·	ductivities and work study	in industri	al manuf	acturing.	
	concept of Micro and concept of Work Meas	•				
	concept of different R					
10. Course Outcomes (COs):	~				
i) Understanding of	of various productiviti	es and work study in indus	trial manuf	facturing.		
ii) Understanding of	of Micro and Memo M	Iotion Study.		-		
	of the concept of Worl					
iv) Understanding (of different Ratings an	d Incentives.				
11. Unit wise detailed of	content					
Unit-1	Number of	Title of the unit: Introd	uction to V	Vork-stu	dv	
	lectures = 11				v	
Productivity: Definit	ion of producti	vity, individual ente	erprises,	task	of ma	nagement
•			er. Measu		-	ductivity,
		improvement programs.				
scope of work study. Hu work study and worker.	iman factor in work s	tudy, Work study and mar	agement, v	work stuc	ly and sup	pervision,
work study and worker.						
Unit – 2	Number of	Title of the unit: Introd	uction to N	Aethod S	tudy	
	lectures = 10					
Introduction to Method		jective and scope of meth	od study, a	activity re	ecording a	and exam
		on – process charts, flow p				
-		and Memo Motion Study				-
		of movements, two handed		hart, SIM	O chart, a	and micro
Unit – 3	Number of	stallation of the improved r Title of the unit: Intro		Work	Accuron	ant and
$\operatorname{Omt} = 3$	lectures = 10	Ergonomics	uucu011 10	WUIK I	vicasui ell	uciii allu
Introduction to Work Ma		a, objective and benefit of v	vork measu	Irement V	Work men	surement
		levels, sample size determ				
	-	upment, selection of job, s		-	-	
	• •	tems of rating. Ergonomic	-	-	-	•
-		ents of man-machine sys				•
ergonomies, man-mach	ne system. compon	ents of man-machine sys	tenn and t	Inchi Tullo	<i>.</i>	Study OI

development of stress in human body and their consequences. Computer based ergonomics. Usability Engineering and Human Computer interface.

Unit – 4	Number of	Title of the unit: Ratings and Incentives
	lectures = 11	

Scales of rating, factors affecting rate of working, allowances and standard time, determination. Predetermined motion time study – Method time measurement (MTM), Wages and Incentives: introduction, definition, wage differentials, methods of wage payment, Advantages, disadvantages, Financial incentives, non-financial incentives.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

 M S Sanders and E J McCormic -Human Factors in Engineering Design, ISBN:13: 9780070549012, Mc Graw Hill, 7th Edition, 1992.

Reference Books

- i) ILO -Introduction to work study, ISBN 13:9788120406025 Publisher: India Book House Pvt. Ltd, 4th Revised Edition,2008.
- ii) Ralph M Barnes -Motion and Time study, ISBN:13:978981426182 Publisher: John Wiley, 7th edition 2009.
- iii) R. S. Bridger -Introduction to Ergonomics, ISBN:13:9780849373060, Publisher Taylor and Francis dated 20th Aug 2008, 3rdEdition

1. Name of the Depart	tment- Mechanical E	Ingineering				
2. Course Name	Supply Chain and Logistic Management	L	7	Г		P
3. Course Code		3		0	0	
4. Type of Course (use	e tick mark)	Core ()	PE (✔)		OE ()	
5. Pre-requisite (if	Industrial	6. Frequency (use	Even	Odd ()	Either	Every
any)	Engineering	tick marks)	(✔)		Sem ()	Sem ()
7. Total Number of Lo	ectures, Tutorials, Pi	ractical (assuming 14 wee	ks of one	semester)	
Lectures = 42		Tutorials = 0	Practica	$\mathbf{l} = 0$		
8. Course Description						
processes from end user chain members, to inclue requires cross-functional that comprise the supply 9. Learning objectives	through original supp de customers and oth integration of key bu chain.	tt (SCM), a term which de pliers for the purpose of ad er stakeholders. This cours isiness processes within th rences between logistics ar	ding value se present e firm and	e for the f s a framev l across th	irm, its ke work for S he network	ey supply SCM that
 iii) An understandin iv) An understandin 10. Course Outcomes (10) i) Understanding th ii) Understanding th iii) Understanding th 	g of the tools and tech	components of supply chain niques useful in implement oletion of the course, the structure Managements. Chain Management supply and demand	nting supp	ly chain n	-	nt.
11. Unit wise detailed c						
Unit-1 Introduction, Logistics s	Number of lectures = 10 ystem design, Deman	Title of the unit: Logisti d planning, Multiple chan			lti-echelo	n system,
Model development, Co Logistics information sys	oncept of warehousin stem, Logistics costin	ng, Methods of storage, F g	rimary an	nd second	lary transj	-
Unit – 2	Number of lectures = 11	Title of the unit: Supply		U		
Understanding the Supply Chain, Process view, Decision phases and importance of supply chain, Supply chain management and logistics, supply chain and the value chain, Competitive advantage, supply chain and competitive performance, changing competitive environment, Supply Chain drivers and obstacle						
Unit – 3	Number of lectures = 10	Title of the unit: Match				
against demand, Deman replenishment.	The lead-time gap, Improving the visibility of demand, supply chain fulcrum, forecast for capacity, execute against demand, Demand management and aggregate planning, Collaborative planning, forecasting and replenishment.					
Unit – 4	Number of lectures = 11	Title of the unit: Strateg	gic Manag	gement		

Creating the responsive supply chain Product 'push' versus demand 'pull' The Japanese philosophy, Foundations of agility, Route map to responsiveness. Strategic lead-time management: Time-based competition, Lead-time concepts, Logistics pipeline management. Planning and managing inventories in a supply chain: managing economies of scale in supply chain cycle inventory, managing uncertainty in supply chain, determining optimal level of product availability.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Chopra, S. and Meindl, P. "Supply Chain Management", Prentice Hall, 6th Edition, 2016, ISBN: 0133800202

Reference Books

- i) Christopher, M. Logistics & Supply Chain Management, FT Prentice Hall, 5th Edition, 2016, ISBN: 1292083794.
- ii) John T. Mentzer, J. T. Supply Chain Management, illustrated edition, SAGE Publications (2001), 1st Edition, ISBN: 1412918057
- iii) Michael H. Hugos, M. H. Essentials of Supply Chain Management, John Wiley, (2011), 3rd Edition, ISBN: 0470942185

1. Name of the Depa	rtment- Mechanical	Engineering		
2. Course Name	Finite Element Methods	L	Т	Р
3. Course Code		3	0	0
4. Type of Course (u	ise tick mark)	Core ()	PE (✓)	OE ()
5. Pre-requisite (if any)	Mechanical Machine Design	6. Frequency (use tick marks)	Even Odd () (✓)	Either Every Sem () Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 00	Tutorials = 00	Practical = 42

8. Brief Syllabus

The finite element method (FEM) is among one of the most powerful tool for the numeric solution of wide range of engineering problems. The application ranges from deformation and stress analysis of civil and mechanical structures, automotive components, aircraft designs, heat flux analysis, fluid flow problems, electrical magnetic flux problem. Upon completion, students should be able to solve the problems in solid mechanics and heat transfer using FEM..

9. Learning objectives:

- i) To enable the students, understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis.
- ii) To understand the characteristics of various finite elements.
- iii) To develop finite element equations for simple and complex domains.
- iv) To understand ANSYS and CAD tools.

10. Course Outcomes (COs):

- i) Apply the knowledge of mathematics and engineering to solve problems in structural and thermal engineering by approximate and numerical methods.
- ii) Design a new component or improve the existing components using FEA.
- iii) Solve the problems in solid mechanics and heat transfer using FEM.
- iv) Use commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life problems.

11. Unit wise detailed content							
Unit-1	Number of Title of the unit: Introduction						
	lectures = 10						
Introduction to FEM. Me	ethod of weighted resi	duals and variational approach for solving differential equations.					
Unit – 2	Number of	Title of the unit: Discretization					
	lectures = 10						
Element types and prop	perties. Boundary con	ditions. Stress-strain determination. Solution techniques. Mesh					
refinement. Convergence	e criterion. Frames, be	ams and axial element. Plane stress. Plane strain. of shape function					
equations.							
Unit – 3	Number of	Title of the unit: FEM Formulation					
	lectures = 10						

Finite element formulation for linear elastic continuum and extended Laplace equation including inertia and dissipative terms. Plate bending and 'C' elements. Non-conforming elements and patch test. FEM analysis of plates and shells.

Unit – 4	Number of	Title of the unit: Problems
	lectures = 12	

Dynamic and nonlinear problems, Material and geometric non-linearity. Axisymmetric problems-classical solution. Finite Element solution of free vibration problems. Principles of transient dynamic analysis. Laboratory work for the solution of solid mechanics problems using FE packages, Current industry trends.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Bo	13. Books Recommended				
Textbo	ook				
i)	Tirupathi R. Chandrupatla (2009), Finite Element Analysis for Engineering and Technology, 1st Edition,				
	University Press. ISBN: 978-8-173-71427-6.				
Refere	ence Books				
i)	P. Seshu (2010), Text book of Finite Element Analysis, Prentice Hall of india. ISBN: 978-8-120-32315-				
	5.				
ii)	J.N. Reddy (2005), An Introduction to the Finite Element Method, McGraw-Hill, Third Edition. ISBN:				
	978-0-070-60741-5.				
iii)	S. S. Rao (2012), The Finite Element Method in Engineering, 5th Edition, Elsevier. ISBN: 978-9-380-				
	93155-5.				
iv)	O.C. Zienkiewicz, R.L. Taylor and J. Z. Zhu (2005), The Finite Element Method: Its Basis and				
	Fundamentals, 6th Edi-tion, Butterworth-Heinemann. ISBN: 978-0-750-66320-5.				

1.	Name of the	Department: Mechanica	l Engineering						
2.	Course	Biomaterials	L	Т			Р		
	Name								
3.	Course		3	0			0		
	Code		C C	v		Ū			
4.		rse (use tick mark)	Core ()	PE (✓) OE ()					
5.	Pre-	Material Engineering	6. Frequency	Even	Odd	Either	Every Sem		
5.	requisite	& Technology	(use tick	(\checkmark)	0	Sem ()			
	requisite	& Technology	(use tick marks)	(•)	0	Selli ()	0		
7	Total Numb	er of Lectures, Tutorials		a 14 waa	lea of or	o comocto			
		er of Lectures, Tutorials					r)		
Lectures = 42Tutorials = 0Practical = 08. Course Description:									
8.	Course Desc								
Αt	biomaterial is	any matter, surface, or con	struct that interacts v	with biold	gical sy	stems. Thi	s course covers		
		nalysis and design of biom			••••				
		dical imaging and clinica							
		les and surfaces; design,							
-		d application of state-of-th		• • •					
	Learning O			510 denes	.o pioci		ae engineering.		
		about Biomaterials.							
		nd common use biomateri	als as metals cerami	cs and no	lymers	and its che	mical		
		, properties and morpholog		es and po	rymers		inical		
		about different types of in							
		new concepts in the interf		atoriala a	ionaa				
10									
10.		comes (COs): On complet				and its also	miaal		
		nd common use biomateri		cs and po	lymens	and its che	micai		
		, properties and morpholog							
		nd the various application							
		nd and account for method				• 1 1 1			
4.4		id account for methods to	characterize interacti	ons betwe	en mat	erials and t	issue.		
		tailed content	1 T:4164	1	r	- 4 •			
Un	it-1	Number of lectures = 1	1 Title of t	ne unit:	Introdu	ction			
De	finition of bio	naterials, requirements &	classification of bion	naterials,	Compai	ison of pro	operties of some		
		rials. Effects of physiolog			-	-	•		
		-vascular system). Surfac					•		
	chanical prop			· 1	2	1 1	,		
	$\frac{1}{1}$ it -2	Number of lectures = 1	0 Title of t	he unit:	Metalli	c implant	materials		
		o-based alloys, Ti and Ti-b				-			
		metal, corrosion behavior							
		ent implant: Orthopedic i							
	-		-	-		-	-		
Percutaneous and skin implants, Vascular implants, Heart valve implants-Tailor made composite in medium									
medium. Unit - 3 Number of lectures = Title of the unit: Ceramic and composite implant									
UI	n = 3	11	materials:		inu con	iposite ini	piant		
Da	finition of his			1	oridoa	Class com	mine Carbone		
Definition of bio ceramics. Common types of bio ceramics: Aluminum oxides, Glass ceramics, Carbons.									
	Bio resorbable and bioactive ceramics. Importance of wear resistance and low fracture toughness. Host								
Bic			-	tissue reactions: importance of interfacial tissue reaction (e.g. ceramic/bone tissue reaction).					
Bic tiss	ue reactions:	importance of interfacial ti	ssue reaction (e.g. ce						
Bio tiss Co	ue reactions: mposite impla	importance of interfacial ti nt materials: Mechanics of	ssue reaction (e.g. ce f improvement of pro	perties by	incorp	orating diff	ferent elements.		
Bio tiss Co Co	ue reactions: mposite impla mposite theor	importance of interfacial ti nt materials: Mechanics of y of fiber reinforcement	f improvement of pro (short and long fibe	perties by	incorp	orating diff	ferent elements.		
Bic tiss Co Co ost	ue reactions: mposite impla mposite theor eogenic fillers	importance of interfacial ti nt materials: Mechanics of y of fiber reinforcement (e.g. hydroxyapatite). Ho	ssue reaction (e.g. co f improvement of pro (short and long fibe st tissue reactions.	perties by ers, fiber	incorp s pull c	orating diff out). Polyn	ferent elements. ners filled with		
Bic tiss Co Co ost	ue reactions: mposite impla mposite theor	importance of interfacial ti nt materials: Mechanics of y of fiber reinforcement	f improvement of pro (short and long fibe	perties by ers, fiber	incorp s pull c	orating diff out). Polyn	ferent elements. ners filled with		

Polyolefin's, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetyls. (Classification according to thermo sets, thermoplastics and elastomers). Viscoelastic behavior: creep-recovery, stress-relaxation, strain rate sensitivity. Importance of molecular structure, hydrophilic and hydrophobic surface properties, migration of additives (processing aids), aging and environmental stress cracking. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.

Reference Books

- i) Biomaterials Science: An Introduction to Materials in Medicine, By Buddy D. Ratner, et. al. Academic Press, San Diego, 1996.
- Amar K. Mohanty, Manjusri Misra and Lawrence T. Drzal (2005), Natural Fibers, Biopolymers, and Bio composites, First Edition, CRC Press. ISBN: 978-0-849-31741-5.
- iii) JB Park and RS Lakes (2010), Biomaterials An Introduction, Springer. ISBN: 978-1-441-92281-6.

1.	1. Name of the Department- Mechanical Engineering							
2.	Course Name	Mechanical Machine Design Lab	L		Τ		Р	
3.	Course Code		0		0		2	
4.	Type of Course	e (use tick mark)	Core (✓)	EAS ()	PE ()		OE ()	
5.	Pre-requisite (if any)	Engineering Graphics and Deign	6. Frequenc marks)	y (use tick	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tutorials,	Practical (assu	ning 14 weeks	of one se	mester)		1
Le	ctures = 0		Tutorials = 0		Practic	cal = 28		

8. Brief Syllabus:

Design of Machine Elements is a required course for mechanical engineering students. This course is an introduction to the basic principles of modern engineering. It provides the students with fundamental skills of engineering and the ability to apply the theories of science to practice and understand the factors; such as stresses, deformations, and failure criteria, influencing the machine elements like shafts, springs, belts, bearings, gears etc. The main objective of design of machine elements is that the machine should function properly to satisfy the needs of the customer and it should be safe against the predicted modes of failure.

9. Learning objectives:

- i) To understand the design methodology for machine elements.
- ii) To analyze the forces acting on a machine element and apply the suitable design methodology.
- iii) To understand the various standards and methods of standardization.
- iv) To apply the concept of parametric design and validation by strength analysis.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Apply modern tools and skills in design and manufacturing to solve real world problems
- ii) Acquire knowledge and study effects of static stress concentrations in machine component
- iii) Acquire knowledge and design of Shafts, Springs and Drives.
- iv) Acquire knowledge and design of keys & coupling

11. Unit wise detailed content					
Sr. No.	Title	COs			
		covered			
1	Study of selection of materials for given applications	i), ii)			
2	Study of effect of different alloying elements on the properties of materials	ii)			
	and comparison of it with properties of steel and ci.				
3	Study of design of mechanical components subjected to fluctuating loads	ii), iii)			
4	Study of selection of mechanical springs for various applications and design	ii), iii)			
	of springs subjected to different loads.				
5	Study of selection and design procedure for belt drives and ropes drives	iii)			
6	Study of selection and design procedure for chain drives	iii)			
7	To understand the design process for a sunk shaft system	iv)			
8	To understand the design process for a power screw system.	i)			

9	To understand the design process for a leaf spring	iii)
10	To understand the design process for a flat belt drive	iii)
11	To understand the design process for Keys and Coupling	iv)
12	To understand the design process for a v-Belt drive	iii)

1. Name of the Depa	artment- Mechanical	Engineering		
2. Course Name	Strength of Materials Lab	L	Т	Р
3. Course Code		0	0	2
4. Type of Course (u	ise tick mark)	Core (✓)	PE ()	OE ()
5. Pre-requisite (if any)	Materials Engineering and Technology	6. Frequency (use tick marks)	Even Odd () (✔)	Either Every Sem () Sem ()
7. Total Number of	Lectures, Tutorials,	Practical (assuming 14 we	eks of one semest	ær)
Lectures = 00		Tutorials =0	Practical = 28	
8. Course Description	n			

Strength of Materials (also known as Mechanics of Materials) is the study of the internal effect of external forces applied to structural member. Stress, strain, deformation deflection, torsion, flexure, shear diagram, and moment diagram are some of the topics covered by this subject.

9. Learning objectives:

- i) To determine experimental data, including universal testing machines.
- ii) To determine experimental data for spring testing machine, compression testing machine, impact tester, hardness tester.
- iii) To determine stress analysis and design of beams subjected to bending and shearing loads using several methods.
- iv) To determine mechanical properties of the mild steel.

10. Course Outcomes (COs): On completion of this course, the students will be able:

- i) To estimate and compare the strength of solid materials using Tension, shear and torsion test.
- ii) To determine and compare the Toughness of the materials using CHARPY and IZOD Test.
- iii) To determine and compare the Brinnell and Rockwell hardness number of the given specimens.
- iv) To determine the bending strength and fatigue strength of specimen using bending test.

11. Lab Content Sr. No. Title COs covered 1 Evaluation of engineering stress-strain diagram on mild steel and cast-iron rods i) under tension. 2 Determine the mechanical Properties of material by bending test on mild steel iv) using universal testing machine. 3 Comparison of hardness values of steel, copper and aluminium using Brinell iii) hardness testing machine. Comparison of hardness values of steel, copper and aluminium using Rockwell 4 iii) hardness testing machine. 5 Determination of spring constant under tension and compression. i)

6	Determination of impact strength for the given specimen using Charpy test	ii)
7	Determination of impact strength for the given specimen using Izod test	ii)
8	Determination of fatigue strength for the given specimen using Fatigue test.	iv)
9	Determination of shear stress for the given specimen using Torsion test	i)
10	Determination of shear strength for the given specimen using double shear test.	i)

1. Name of the Departr	nent- Mechanical E	ngineering				
2. Course Name	Manufacturing Process Lab	L	Т		Р	
3. Course Code		0	0		2	
4. Type of Course (use	tick mark)	Core (✓)	PE	0	OE	0
5. Pre-requisite (if any)		6. Frequenc y (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 00	Tutorials = 0	Practical = 28
8. Course Description		

In this syllabus to introduce about manufacturing process, welding process and other important things which are very needful to a mechanical engineer. Students learn metal cutting operations like turning, milling, drilling, shaping, etc., Joining Processes, Metal Forming Processes, methods of measurements, Super Finishing Processes, Sheet Metal Developments.

9. Learning objectives:

- i) To understand the principles of manufacturing process.
- ii) To learn the principles of welding process.
- iii) To develop the knowledge of selecting the right equipment for a particular application of manufacturing and production.
- iv) To acquire basic knowledge about the behaviour and manufacturing properties of engineering materials and concepts of different machining processes and various methods of measurements..

10. Course Outcomes (COs):

- i) Explain the mechanism of chip formation in machining.
- ii) Explain the various machining processes such as turning, drilling, boring, shaping, slotting, milling and grinding.
- iii) Use the principles of machine tools.
- iv) Choose materials in a manufacturing process based on their properties and conduct experiments on various manufacturing processes.

11. Lab Content

Sr. No.	Title	COs covered
1	Study and Practice of Orthogonal & Oblique Cutting on a Lathe.	i), iv)

2	Machining time calculation and comparison with actual machining time while cylindrical turning on a Lathe and finding out cutting efficiency.	i), iv)
3	Study of Tool Life while Milling a component on the Milling Machine.	i), iv)
4	To establish the relationship between cutting speed, feed rate and depth of cut during forces generated in oblique cutting.	ii), iii), iv)
5	Study of Tool Wear of a cutting tool while Drilling on a Drilling Machine.	iv)
6	Preparation of joint using spot welding.	iv)
7	Preparation of butt joint using arc welding.	iv)
8	Welding of stainless-steel specimen using MIG welding.	iii), iv)
9	Experiment on sheet metal development: Preparation of models – tray, funnel, truncated cone, pyramid, transition piece	iv)
10	Study of various super finishing operations-Lapping, honing, burnishing.	iv)
11	Study of divided head and generation of gear profile on milling machine.	iii)
12	To perform taper turning and thread cutting by different methods on lathe machine.	vi)
13	To select an appropriate grinding wheel to perform cylindrical & surface grinding operation.	iv)
14	Study and practice of Linear and angular measurement instruments	iv)

Department Electives-III Lab

	le of the	e Department meen	anical Engineering				
2. Cour Nam		Cryogenic Engineering Lab	L	Т		Р	
3. Cour Code			0	0		2	
4. Type marl		urse (use tick	Core (✔)	PE ()		OE ()	
5. Pre- requ (if a		Refrigeration & Air Conditioning	6. Frequency (use tick marks)	Even (🗸)	Odd ()	Either Sem ()	Every Sem ()
		per of Lectures, Tuto				nester)	
Lecu	ures = ()	Tutorials = 0	Practica	1 = 28		
			uniciliation in Civo	gennes, Liquid	storage and	l transfer sys	tems, hea
 9. Lear i) Thi ii) It'll iii) The iv) The 10. Court i) It'll ii) Ant iii) Dest iv) Est 	rning ol is course l discus e underse underse rse Out l help us alyses ti scribe b imate th	in cryogenic systems. bjectives: e will describe the fur s the fundamental prin standing of cryogenic standing of various he comes (COs): s in basic concepts of he effects & propertie asic working principle the thermal conductivit	ndamental principles of nciples cryogenics & i refrigeration systems, at exchanges & cryog cryogenic substances s associates with cryo es of cryogenics & ho	f cryogenic su ts usage enic systems genics. w it can be sto	bstances	1 transfer sys	
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9. Lear i) Thi ii) It'll iii) The iv) The 10. Coun i) It'll ii) An iii) Des iv) Est 11. Unit Sr. No. 1	rning ol is course l discus e underse is e underse rse Out l help us alyses ti scribe b imate th wise de T T	bjectives: e will describe the fun s the fundamental prin standing of cryogenic standing of various he comes (COs): s in basic concepts of he effects & propertie asic working principle thermal conductivit etailed content 'itle	adamental principles of nciples cryogenics & i refrigeration systems, at exchanges & cryog cryogenic substances s associates with cryo es of cryogenics & ho ty associated with cryo Cryogenic Fluids & it l conductivity at very	f cryogenic su ts usage enic systems genics. w it can be sto ogenics. s effects on M low temperatu	red. aterials.	CO Co i), i)	vered ii)
9. Lear i) Thi ii) It'll iii) The iv) The 10. Cour i) It'll ii) Ana iii) Des iv) Est 11. Unit Sr. No. 1 2	rning ol is course l discus e underse is e underse rse Out l help us alyses ti scribe b imate th wise do T T T T	bjectives: e will describe the fur s the fundamental prin standing of cryogenic standing of various he comes (COs): s in basic concepts of he effects & propertie asic working principle the thermal conductivit etailed content Title To study Properties of to compute the therma	adamental principles of nciples cryogenics & i refrigeration systems, at exchanges & cryog cryogenic substances s associates with cryo es of cryogenics & ho ty associated with cryo Cryogenic Fluids & it al conductivity at very nsulating materials use	f cryogenic su ts usage <u>enic systems</u> genics. w it can be sto ogenics. s effects on M low temperatu ed in cryogenic	bstances red. aterials. ure c application	CO Co i), i) s iii)	vered ii)
9. Lear i) Thi ii) It'll iii) The iv) The 10. Cour i) It'll ii) Ana iii) Des iv) Est 11. Unit Sr. No. 1 2 3	rning ol is course l discus e unders rse Out l help us alyses ti scribe b imate th wise do T T T T T	bjectives: e will describe the fun- s the fundamental prin standing of cryogenic standing of various he scomes (COs): s in basic concepts of he effects & propertie asic working principle the thermal conductivit etailed content Title To study Properties of to compute the thermat to compare different in to compare different in	adamental principles of nciples cryogenics & i refrigeration systems. at exchanges & cryog cryogenic substances s associates with cryo es of cryogenics & ho ty associated with cryo Cryogenic Fluids & it al conductivity at very nsulating materials use and through insulation.	f cryogenic su ts usage <u>enic systems</u> genics. w it can be sto ogenics. s effects on M low temperatu ed in cryogenic	bstances red. aterials. ure c application	CO Co i), s iii) s iii)	vered ii)

7	To study cryo - refrigeration system, isothermal source system, isobaric source system.	iii)
8	To study working of magnetic refrigerator & thermal valves.	i), iii)
9	To study liquefaction system – ideal liquefaction system, simple Linde Hampson model	ii), iii)
10	To study liquefaction system – pre cooled Linde Hampson model	ii)

•	Course Name	Computer Aided Manufacturing Lab		L	T		Р	
3.	Course Code			0	0		2	
4.	Type of Course (use tic	k mark)		Core ()	PE	(✔)	OE	0
5.	Pre-requisite (if any)	Machining Processes and Technology	6.	Frequency (use tick marks)	Even O	Odd (✓)	Either Sem ()	Every Sem ()

Lectures = 0	Tutorials = 0	Practical = 28
8. Course Description		

CAD is the use of computer systems to assist in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. Students learn the importance of CAD/CAM principles in the Product development, programs related to manufacturing using codes and analyze the importance of networking in manufacturing environment.

9. Learning objectives:

- i) To understand the basics of CAD/CAM and concepts of computer graphics.
- ii) To learn about the geometric issues concerned to the manufacturing and its related areas.
- iii) To understand the latest advances in the manufacturing perspectives and their applications.
- iv) To understand the working of G and M codes.

10. Course Outcomes (COs):

- i) To understand the importance of CAD/CAM principles and computer hardware in the Product development.
- ii) To understand the principles of computer graphics.
- iii) To develop programs related to manufacturing using codes.
- iv) To learn the concepts of group technology, flexible manufacturing system and computer integrated manufacturing system.

11. Lab Content

Sr. No.	Title	COs covered
1	Use and learn import/export techniques and customization of software.	i)

2	Construction of simple machine parts and components like Coupling, Crankshaft, Pulley, Piston, Connecting rod, nuts, bolts, gears and helical springs.	i)
3	Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing, Drill jigs and Milling fixture.	i)
4	Make the part family/family table of a bolt	i)
5	Tool path generation	i)
6	Part programming	ii)
7	G & M codes development for machining operations	ii), iv)
8	Physical interpretation of machining features and tool geometries	iii)

1.	Name of the De	partment- Mechanical I	Engineering				
2.	Course Name	Hydrogen and	L	r	Г]	Р
		Fuel Cells Lab					
3.	Course Code		0	(0		2
4.	Type of Course	(use tick mark)	Core ()	PE (✓)		OE ()	
5.	Pre-requisite (if	f Automobile	6. Frequency (use	Even	Odd ()	Either	Every
	any)	Engineering	tick marks)	(✔)		Sem ()	Sem ()
7.	Total Number of	of Lectures, Tutorials, P	ractical (assuming 14 wee	eks of one	semester)	
Le	ctures = 0		Tutorials = 0	Practica	l = 28		
8.	Course Descrip	tion					
Th	is course provides	s students a brief overvie	ew on Hydrogen and Fuel	cells. This	s includes	understar	nding the
nev	west energy variar	nts. Also give overview h	ow to store and utilize thes	e energies.	•		
9.	Learning object	tives:					
	i) The objectiv	e of the course is to provi	de comprehensive and logi	cal knowle	edge of hy	drogen pr	oduction.
	ii) Knowledge	of storage and utilization	of Hydrogen.				
	iii) To provide a	n understanding of variou	us fuel cell technologies				
	iv) To know the	application of Fuel cells.					
10	. Course Outcom	nes (COs):					
	i) Evaluate the	performance of fuel cells	s under different operating	conditions			
		** *	ll technology for a given ap	-			
	-		n storage system to be used	-		-	
		vironmental hazards asso	ciated with the use of hydr	ogen stora	ige and fu	el cell tecl	nnology.
11	. Lab Content						
Sr.	No. T	Title				CO	
	1 T	la Study the hydrogen and	mary avatama			CO	vered
		o Study the hydrogen ene					iv)
	2 T	o Study the various Hydr	rogen production processes				iii), iv)
	3 T	o study the various Hydro	ogen Storage systems.				iii), iv)
	4 T	o Study the Hydrogen Ut	tilization				iii), iv)
	5 T	o study the evaluation pro-	ocess of fuel cells				i), ii)
	6 T	o study the Fuel cells per	formance.				i), ii)
	7 T	o study the application of	f Hydrogen and Fuel Cell			i)	, ii), iii), iv)
		o design and develop the echnology.	Hydrogen storage in comb	oination wi	th fuel cel	11	iii)

2. Course Na	Material Handling Lab]	Р			
3. Course Co	ode	0			0	, ,	2
4. Type of Co	ourse (use tick mark)	Core ()	EAS ()	PE (✔))	OE ()	
5. Pre-requist (if any)	ite	6. Frequency marks)	(use tick	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Num Lectures = 0	ber of Lectures, Tutorials,	Practical (assum Tutorials = 0	ing 14 weeks		mester) cal = 28		
Lectures = 0		1 utorials = 0		Pracuo	cal = 28		
 9. Learning of i) Learn ti ii) Learn ti iii) Learn ti iv) Learn ti 	he basic concept of Worksta he basic concept Layout con he basic concept Computeriz he basic concept Assessmen	tions struction technique zed Layout and An t and Evaluation	es alytical Metho	ods			
i) Undersii) To addaiii) Unders	tcomes (COs): After the contanding the concept of Work ress the underlying concepts tanding the concept of Comp tanding the concept of Asses nt	estations of Layout constru puterized Layout a	ction techniqu nd Analytical	ies	e able to		
Sr. No.	Title					Cos cove	ered
1	To Study the Production study	, activity and mate	erials flow ana	lysis usin	g case		i)
2	To Study the Facilities d						i)

5	To Study the Systematic layout planning using case study	ii)
6	To study the Manufacturing operation using case study	ii)
7	To study the Warehouse operations using case study	iii)
8	To study the AS/RS and simulation model using case study	iii)
9	To study the Assessment and evaluation of layout alternatives Projects using case study	iii)
10	To study the Use Spiral software to practice plant layout design using case study	iv)

2.	Course Name	Lean enterprise &	I	[,	,	Г	1	P
		Advanced				_		_
		Manufacturing						
		Technologies Lab						
		I comologies Lab						
3.	Course Code		(0	(0		2
4.	Type of Cours	e (use tick mark)	Core ()	BSC ()	PE (✓))	OE ()	
5.	Pre-requisite	Industrial	6. Frequency	v (use tick	Even	Odd	Either	Every
	(if any)	Engineering	marks)		(√)	0	Sem ()	Sem
	× • • •		,		(.)	V	Sem ()	0
								V
		of Lectures, Tutorials,		ning 14 weeks				
Le	ctures = 0		Tutorials = 0		Practic	cal = 28		
8.	Course Descrip	ption						
Th	is is a course h	based on lean thinking,	enterprise proce	ess re-engineer	ng, and	digital 1	manufactu	ring an
		valent in the work place, ϵ	· ·	÷	•	•		•
	v	holistic system of techno	0	•		-	.	
		ourse to graduates with e						
-		-	-	-		-		
			This course is a	deal for wishing	to transfe	er smoot	hlv and eff	ectivel
	-	0 1		deal for wishing	to transfe	er smoot	hly and eff	ectivel
to a	a career in the ma	anufacturing sector and o		deal for wishing	to transfe	er smoot	hly and eff	fectively
to a	a career in the ma Learning obje	anufacturing sector and o ctives:	f industry.				-	fectivel
to a	a career in the ma Learning object i) To develop	anufacturing sector and o ctives: lean thinking and, enterp	<u>f industry.</u> prise process re-e	engineering con	cept, & Ji	idoka Co	oncept	
to a	 a career in the matching object b To develop c To explain 	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech	<u>f industry.</u> prise process re-e miques for Stabi	engineering con ility of Lean Sy	cept, & Ji	idoka Co	oncept	
to a	 a career in the main career in the main career in the main care i	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing metho	f industry. orise process re-e nniques for Stabi ods for different a	engineering con ility of Lean Sy applications.	cept, & Ji stem & Ju	idoka Co	oncept	
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to a 9. 10.	 a career in the mathematical career in	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it i mes (COs): After the con	f industry. orise process re-e- nniques for Stabi ods for different a in various engine opletion of the co	engineering con ility of Lean Sy applications. æring applicati	cept, & Ji stem & Ju ons.	idoka Co 1st In Ti	oncept	
to a 9. 10.	 a career in the mathematical career is a career in the mathematical career is a career in the mathematical career in the	anufacturing sector and o ctives: • lean thinking and, enterp advanced production tech Plastic Processing methor • Press tools and apply it i mes (COs): After the con his course, the students w	f industry. prise process re-en- prise process re-en- prise for Stabi- pods for different and in various engine pletion of the co- ill be able to:	engineering con ility of Lean Sy applications. eering applicati ourse, the stude	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	
to a 9. 10.	 a career in the main career in the main career in the main career in the main care of the main care	anufacturing sector and o ctives: • lean thinking and, enterp advanced production tech Plastic Processing methor • Press tools and apply it i mes (COs): After the con his course, the students w ling the Introduction & Ji	f industry. prise process re-en- niques for Stabi- ods for different a in various engine pletion of the co- ill be able to: doka Concept (A	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	
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to a 9. 10.	 a career in the mathematical career in the mathematical care of the mathematical care o	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it is mes (COs): After the con- his course, the students w ling the Introduction & Ji- ling the Stability of Lean ling the concept and Intro-	f industry. prise process re-en- niques for Stabi- ods for different is in various engine pletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	
<u>to</u> : 9. 10. On	 a career in the mathematical career in the mathematical career in the mathematical care of the mathematical care	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it i mes (COs): After the con his course, the students w ling the Introduction & Ji ling the Stability of Lean	f industry. prise process re-en- prise process re-en- prise for Stabi- ods for different is in various engine pletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	
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to : 9. 10. On 11.	 a career in the mathematical career in the mathematical career in the mathematical care of the mathematical	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it is mes (COs): After the con- his course, the students w ling the Introduction & Ji- ling the Stability of Lean ling the concept and Intro-	f industry. prise process re-en- prise process re-en- prise for Stabi- ods for different is in various engine pletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	
to : 9. 10. On 11.	 a career in the mathematical career in the mathematical career in the mathematical care of the mathematical	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it i mes (COs): After the com his course, the students w ling the Introduction & Ji ling the Stability of Lean ling the concept and Intro ling the concept of Press	f industry. prise process re-en- prise process re-en- prise for Stabi- ods for different is in various engine pletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	
to : 9. 10. On 11.	a career in the mail Learning object i) To develop ii) To explain iii) To Explain iii) To Explain iv) To Classify Course Outcom completion of the instand ii) Understand iii) Understand iii) Understand iii) Understand iii) Understand iii) Understand No.	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it i mes (COs): After the com his course, the students w ling the Introduction & Ji ling the Stability of Lean ling the concept and Intro ling the concept of Press	f industry. prise process re-en- niques for Stabi- ods for different a in various engine npletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti Tools Introduction	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	
to : 9. 10. On 11.	a career in the mail Learning object i) To develop ii) To explain iii) To Explain iii) To Explain iv) To Classify Course Outcord completion of the complexity o	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it i mes (COs): After the com- his course, the students w ling the Introduction & Ji- ling the Stability of Lean ling the concept and Intro ling the concept of Press ' Title	f industry. prise process re-en- niques for Stabi- ods for different a in various engine pletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti <u>Tools Introduction</u> systems.	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	ered
to : 9. 10. On 11.	a career in the mail Learning object i) To develop ii) To explain iii) To Explain iii) To Explain iv) To Classify Course Outcoor completion of the intervence o	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it is mes (COs): After the com- his course, the students w ling the Introduction & Ji ling the Stability of Lean- ling the concept and Intro- ling the concept of Press ' Title To Study the Poke-Yoke	f industry. prise process re-en inques for Stabi- ods for different a in various engine apletion of the co doka Concept (A System & Just in duction to Plasti Tools Introduction systems. systems.	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	ered i)
to : 9. 10. On 11.	a career in the mail Learning object i) To develop ii) To explain iii) To Explain iii) To Explain iv) To Classify Course Outcord completion of the intervention of the interventinterventintered of the intervention of the intervention of the int	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it is mes (COs): After the com- his course, the students w ling the Introduction & Ji- ling the Stability of Lean ling the concept and Intro- ling the concept of Press ' Title To Study the Poke-Yoke To Study the Implementa	f industry. prise process re-en- prise process re-en- prise for Stabi- ods for different and pletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti- Tools Introduction systems. ation of Jidoka.	engineering con ility of Lean Sy applications. eering applicati ourse, the stude Automation with n Time ics Processing on	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	ered i) i)
to : 9. 10. On 11.	a career in the mail Learning object i) To develop ii) To explain iii) To explain iii) To Explain iv) To Classify Course Outcor completion of the intervence of	anufacturing sector and o ctives: lean thinking and, enterp advanced production tech Plastic Processing methor Press tools and apply it is mes (COs): After the com- his course, the students we ling the Introduction & Ji- ling the Stability of Lean- ling the concept and Intro- ling the concept of Press ' Title To Study the Poke-Yoke To Study the Implementa To study the 5S system u	f industry. prise process re-en- miques for Stabi- ods for different a in various engine mpletion of the co- ill be able to: doka Concept (A System & Just in duction to Plasti <u>Tools Introduction</u> systems. tion of Jidoka. sing case study. m mapping using	engineering con ility of Lean Sy applications. æring applicati ourse, the stude Automation with n Time ics Processing on	cept, & Ji stem & Ju ons. nt shall be	idoka Co 1st In Ti e able to	oncept me	ered i) i) i)

7	To study the blanking, and piercing operation.	iii)
8	To study the Die Accessories using case study.	iii)
9	To study the Shear action in die cutting operation using case study.	iv)
10	To study the Constructional details of a power press using case study.	iv)

2.	Course Name	Mechanical Vibration Lab	L	Т		Р	
3. (Course Code		0	0		2	
4. 7	Type of Course (use	e tick mark)	Core ()	PE (✔)		OE	0
	Pre-requisite (if any)	Basics of Mechanical Engineering	6. Frequency (use tick marks)	Even (✓)	Odd 0	Either Sem ()	Every Sem ()

Lectures = 00	Tutorials = 0	Practical = 28
8. Course Description		

A structure or a body is said to vibrate if it has a to and fro motion. A greater proportion of human activities involve vibration in one form or the other. We hear because our eardrums vibrate. The cause and effects of vibration must be clearly understood. The structures designed to support the high speed machines are subjected to inherent unbalance which causes problems. The unbalance may be due to faulty design or poor manufacture. Because of cyclic vibration, the material of the structure or the machine component may undergo fatigue failure. Vibration causes fasteners such as nuts of the machine to become loose. In metal machining processes, vibration may cause chatter, which results in poor surface finish. If the natural frequency of vibration of a machine or structure equals the forced frequency caused by external excitation, resonance occurs which causes dangerously large oscillations and the structure fails. A bridge can collapse due to wind-induced vibrations. Critical instruments mounted on machines may lose their accuracy due to excessive vibrations. Vibrations can be used for useful works such as vibration testing equipment's, vibratory conveyors, hoppers, sieves, compactors, washing machines.

9. Learning objectives:

- i) To learn the basics of vibrations including causes and effects of vibrations.
- ii) To study the undamped and damped free vibration.
- iii) To study the forced vibrations.
- iv) To study multi degrees of freedom system and vibration measuring instruments.

10. Course Outcomes (COs):

- i) Understanding the fundamentals concepts of vibration.
- ii) To understand the free and forced vibrations with two-degree freedom system
- iii) To learn the methods to solve vibration problems with multi-degree freedom system.
- iv) To understand the basics of vibration of continuous systems and experimental methods in vibration analysis and working of vibration measuring instruments.

11. Lab Content

Sr.	Title	CO covered
No.		
1	To study the forced vibration of the beam for different damping.	i), ii), iii), iv)
2	To determine the radius of gyration 'k' of a given compound pendulum.	i)
3	To determine the radius of gyration of trifilar suspension.	i)
4	To determine the radius of gyration of given bar using bi-filler suspension.	i)
5	To verify the dunker lay's rule viz.	ii), iii)
6	To study the pressure profile of lubricating conditions of load and speed.	v)
7	To determine the natural frequency of undamped torsional vibration of a single rotor shaft system.	i), ii), iii), iv)
8	To determine the frequency of undamped free vibration of an equivalent spring mass system.	i), ii), iii), iv)
9	To determine the frequency of damped force vibration of a spring mass system.	i), ii), iii), iv)
10	To determine the frequency of undamped free vibration of an equivalent spring mass system.	i), ii), iii), iv)

2. Cour	se Name	Nano Materials Lab	L	T		Р	
3. Cour	se Code		0	0		2	
4. Type of Course (use tick mark)Core ()PE (\checkmark)OE ()						OE ()	
5. Pre-r any)	equisite (if		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total	Number of L	ectures, Tutorials, I	Practical (assuming 14 w	eeks of one	semester	·)	
Lectures	= 0		Tutorials = 0	Practica	al = 28		
8. Cour	se Description						
 i) T ii) T iii) T iv) T 10. Court i) U 	To understand the To enhance the late To allowing stud se Outcomes (Use of Nanomat	ne basic concepts of s ne basic concepts of l knowledge of Nano r lents to get familiariz COs): On completio erials for various ind	Nano-coating. naterial. zed with Microencapsulati n of this course, the stude	ents will be a	ble to		
			properties of Nano materia		, crystal s	structure, r	eactivity
a	nd electrical pro	operties.					-
iv) D	escribe Microe	encapsulation and the	eir application in industry				
11. Lab	Component						
Sr. No.	Title					COs cov	vered
1	To study the	process of synthesis	of Nano materials				i)
2	To study the	effect of reinforceme	ent on properties of Nano	materials			i)
3	To study the	3 To study the Physical routes for preparation of Nano materials					i)
	To study the	Physical routes for p				+ .	
4	To study the		ings developed using CVI	D and PVD		1	i)
4 5		nano-structured coat	ings developed using CVI developed using CVD and				i) i)

7	To study the effect in mechanical properties of nanostructured coatings.	iii)
8	To study the effect in physical and other properties of Nanostructured coatings.	iii)
9	To study the Current trends in the Nanomaterials.	iv)
10	To study amorphization and crystallization by Milling Process.	iv)
11	To study the Main problems in synthesis of Nanomaterials	iv)

Department Electives-IV Lab

2.	Course Name	Fluid Power System Lab	L	Т		Р	
3.	Course Code		0	0		2	
4.	Type of Co mark)	ourse (use tick	Core ()	PE (✓)		OE ()	
	Pre- requisite (if any) Total Num	Fluid Mechanics and Fluid Machinery iber of Lectures, T	6. Frequency (use tick marks) utorials, Practical (Even (✓) assuming 14	Odd () weeks of one	Either Sem () e semester	Every Sem ()
	Lectures =	: 0	Tutorials = 0	Practica	$\mathbf{l} = 28$		
9.	Learning						
i i i	ii) To learn componeiii) Understaiv) To learn	nding of basics of hyd students about the util ents. nd the control of Hyd about fluid power mai	Iraulics and pneumatic ization of cylinders, a raulic and Pneumatic s intenance and troubles e end of this course, th	ccumulators, va systems. hooting.	alves and vario		rces).
i i 10. i i i i	 ii) To learn component component component iii) Understant iv) To learn Course Out ii) Find the pneumati iii) Gets exp symbols iii) Gain known component iii) Gain known compumps. 	nding of basics of hyd students about the util ents. nd the control of Hyd about fluid power main atcomes (COs): At the importance of fluid po- ic components. osure to the basics of it used in industrial appli- owledge of that how to owledge of the various	ization of cylinders, a raulic and Pneumatic s intenance and troubles e end of this course, th ower technology in ind fluid flow including th	e learner will b ustries and to o e physical lawa	alves and vario be: obtain knowled s affecting flui c Systems.	lge on hydr	raulic and
i i 10. i i 11.	 ii) To learn component component component iii) Understant iv) To learn Course Out ii) Find the pneumati ii) Gets exp symbols iii) Gain known component iii) Gain known compute component iiii) Gain known compute company. Unit wise compute company compa	nding of basics of hyd students about the util ents. nd the control of Hyd about fluid power main atcomes (COs): At the importance of fluid po- ic components. osure to the basics of the used in industrial applovledge of that how to owledge of the various detailed content	ization of cylinders, a raulic and Pneumatic s intenance and troubles e end of this course, th ower technology in ind fluid flow including th lications.	e learner will b ustries and to o e physical lawa	alves and vario be: obtain knowled s affecting flui c Systems.	lge on hydr d standards blems relate	raulic and and ed to
i i 10. i i i i	 ii) To learn component component component iii) Understant iv) To learn Course Out ii) Find the pneumati ii) Gets exposymbols iii) Gain known component iii) Gain known computer component iii) Gain known computer company. Unit wise computer company. The computer computer company comp	nding of basics of hyd students about the util ents. nd the control of Hyd about fluid power main atcomes (COs): At the importance of fluid po- ic components. osure to the basics of it used in industrial appli- owledge of that how to owledge of the various	ization of cylinders, a raulic and Pneumatic s intenance and troubles e end of this course, th ower technology in ind fluid flow including th lications.	e learner will b ustries and to o e physical lawa	alves and vario be: obtain knowled s affecting flui c Systems.	lge on hydr	raulic and and ed to

2	Design and Testing of Two Hand operated Pneumatic Double Acting	i)
	Cylinder (Direct Method).	
3	Design and Testing of Two Hand operated Pneumatic Double Acting Cylinder (Indirect Method).	i)
4	Design and Testing of PneumaticSingle Acting Cylinder by two DCV's – Shuttle (OR) and Dual Pressure (AND) valve	iv)
5	Design and Testing of Pneumatic Metering-In and Metering-Out circuit.	ii), iii)
6	Design and Testing of Pneumatic two Double Acting Cylinder Synchronization circuits (Cylinders connected in Series and Parallel)	i), ii)
7	Design and Testing of Single Cycle operation of Pneumatic Double Acting Cylinder.	iii)
8	Design and Testing of Multi Cycle operation of Pneumatic Double Acting Cylinder.	i), iii)
9	Design and Testing of two Pneumatic Double Acting Cylinder Sequencing circuit (A+ B+ B- A-)	iii)
10	Design and Testing of Single acting cylinder reciprocating system using Electro-Pneumatics	ii)

2. Course Name	CNC Programming Lab	L			T		Р
3. Course Code			0		0		2
4. Type of Course	e (use tick mark)	Core ()	EAS ()	PE (✓	PE (✓)		
1. Pre-requisite (if any)		2. Frequenc marks)	y (use tick	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
3. Total Number	r of Lectures, Tutorials, 1	Practical (assu	ning 14 week	s of one se	mester)		
Lectures = 0		Tutorials = 0		Practi	cal = 28		
4. Course Descr	iption						
 iii) To underst iv) To underst 6. Course Outco i) Practice C ii) Acquire kn iii) To underst 	tand the concept of CNC m tand the concept of CNC to tand the concept of compu- tomes (COs): On completion NC Programming effective nowledge and use simple C tand fundamentals of the C tand the computer aided participation	echnology using ter aided part pro- on of this course ely. CNC machine to CNC technology	y part program ogramming. , the students ols & applica using part pr	will be able			
Sr. No.	Title					CO	
	The						ered
1	To study the NC machine	;					i)
2	To study the CNC machin	ne					i)
3 To study the DNC machine					i)		
4	To study the Construction machining center.	nal detail of CN	C turning cen	ter and CN	С		ii)
5.	To study the Tooling requ	uirements of CN	C machines				ii)
6	To study the Pre-set and o	qualified tools,	Work and too	l holding de	evices in		ii)

7	To study the R Manual part programming for a turning center	iii)
8	To study the Programming using tool nose radius compensation	iii)
9	To study the Tools offsets, Do loops, sub routines and fixed cycles.	iii)
10	To study the CAD based part programming.	iv)
11	To study the CAM based part programming.	iv)
12	To study the APT, COMPACT II, CAD/CAM based part programming.	iv)

2.	Course	Chassis Design	anical Engineering L		Т		Р	
	Name	Lab		1				
3.	Course Code		0		0		2	
4.	Type of Cou mark)	urse (use tick	Core ()	PE (✓)	OE 0	MS ()		
5.	Pre- requisite (if any)	Advance Graphics Design	6. Frequency (use tick marks)	Even (🗸)	Odd ()	Either Sem ()	Every Sen ()	
7.			orials, Practical (ass			semester)		
	Lectures = (Tutorials = 0	Practi	cal = 28			
and 9. 10.	frame system Learning ob i) The stude automotiv ii) Understan iii) Understan iv) Understan Course Outo i) The stude	s. jectives: ent will be able to un ve chassis, nd the complete desi nd the Clutch Design nd the Gear Box Des comes (COs): After	ign. the completion of the	ental principle e at important	es involved dimensions	in design of co	omponents o	
	iii) Design th	e front axle and Stee e clutch for flawless	rent areas of automob ering system of an aut power transmission. intenance of Transmi	ile chassis co omobile.	mponent de	sign.		
	iii) Design thiv) Analyze t	e front axle and Stee e clutch for flawless he assembly and ma	ering system of an aut power transmission.	ile chassis co omobile.	mponent de	sign.		
11.	iii) Design thiv) Analyze tLab Conten	e front axle and Stee e clutch for flawless he assembly and ma t	ering system of an aut power transmission.	ile chassis co omobile. ssion line of	mponent de an automobi	sign.	COs covered	
11.	iii) Design thiv) Analyze tLab Conten	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experin	ering system of an aut power transmission. intenance of Transmi	ile chassis co omobile. ssion line of	mponent de an automobi	sign.		
11.	 iii) Design th iv) Analyze th Lab Conten No. 	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experin Complete design o	ering system of an aut power transmission. intenance of Transmi nent should be perfo	ile chassis co omobile. ssion line of a rmed on Sof	mponent de an automobi	sign.	covered	
11.	 iii) Design th iv) Analyze th Lab Conten No. 	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experin Complete design o	ering system of an aut power transmission. intenance of Transmi nent should be perfor f clutch components. of clutch using draft	ile chassis co omobile. ssion line of a rmed on Sof	mponent de an automobi	sign.	covered i), iii)	
11.	 iii) Design th iv) Analyze th Lab Conten No. 1 2 	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experim Complete design o Assembly drawing	ering system of an aut power transmission. intenance of Transmi nent should be perfor f clutch components. of clutch using draft ions.	ile chassis co omobile. ssion line of a rmed on Sof	mponent de an automobi	sign.	covered i), iii) i), iii)	
11.	iii) Design the iv) Analyze to the iv Analyze to the iv Analyze to the iv Analyze to the interval of the in	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experin Complete design o Assembly drawing Gear train calculat	ering system of an aut power transmission. intenance of Transmi nent should be perfor f clutch components. of clutch using draft ions.	ile chassis co omobile. ssion line of a rmed on Sof	mponent de an automobi	sign.	covered i), iii) i), iii) i), iii) i), iv)	
11.	iii) Design the iv) Analyze to the iv Analyze to the iv Analyze to the iv Analyze to the interval of the in	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experim Complete design o Assembly drawing Gear train calculat Layout of gear box	ering system of an aut power transmission. intenance of Transmi nent should be perfor f clutch components. of clutch using drafti ions.	ile chassis co omobile. ssion line of a rmed on Sof	mponent de an automobi	sign.	covered i), iii) i), iii) i), iv) i), iv)	
11.	iii) Design the iv) Analyze to the iv Analyze to the iv Analyze to the iv Analyze to the intervention of the intervention o	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experim Complete design o Assembly drawing Gear train calculat Layout of gear box Calculation of bear	ering system of an aut power transmission. intenance of Transmi nent should be perfor f clutch components. of clutch using drafti ions.	ile chassis co omobile. ssion line of a rmed on Sof	mponent de	sign.	covered i), iii) i), iii) i), iv) i), iv) i), iv) i), iv)	
11.	 iii) Design th iv) Analyze th Lab Content No. 1 2 3 4 5 6 	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experim Complete design o Assembly drawing Gear train calculat Layout of gear box Calculation of bear	ering system of an aut power transmission. intenance of Transmi nent should be perfor f clutch components. f of clutch using drafti ions.	ile chassis co omobile. ssion line of a rmed on Sof	mponent de	sign.	covered i), iii) i), iii) i), iv) i), iv) i), iv) i), iv) i), iv) i), iv)	
11.	 iii) Design th iv) Analyze th Lab Conten No. 1 2 3 4 5 6 7 	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experim Complete design o Assembly drawing Gear train calculat Layout of gear box Calculation of bear Selection of bearin Assembly drawing	ering system of an aut power transmission. intenance of Transmi nent should be perfor if clutch components. of clutch using drafti ions. c. ring loads gs. of gear box using draft r shaft.	ile chassis co omobile. ssion line of a rmed on Sof	mponent de	sign.	covered i), iii) i), iii) i), iv)	
	 iii) Design th iv) Analyze th Lab Conten No. 1 2 3 4 5 6 7 8 	e front axle and Stee e clutch for flawless he assembly and ma t Title (All Experim Complete design of Assembly drawing Gear train calculat Layout of gear box Calculation of bear Selection of bear Assembly drawing Design of propelle Design details of f	ering system of an aut power transmission. intenance of Transmi nent should be perfore if clutch components. of clutch using draft ions. c. ring loads ags. of gear box using draft inal drive gearing. ull floating, semi-floa e housings	ile chassis co omobile. ssion line of a rmed on Sof ing software.	re.	sign. le.	covered i), iii) i), iii) i), iv) i), iv)	

1.	Name of the Dep	artment- Mechanical H	Engineering						
3.	Course Name	Work Study Lab	L		Т		Р		
4.	Course Code		0		0		2		
5.	Type of Course	e (use tick mark)	Core ()	EAS ()	PE (✓	PE (✓) OE ()			
6.	Pre-requisite (if any)		7. Frequency marks)	y (use tick	Even (✓)	Odd ()	Either Sem ()	Every Sem ()	
8. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)									
Lectures = 0			Tutorials = 0		Practical = 28				

9. Course Description

This is a course based on Work study and industrial engineering play important role in job simplification, job design, job enrichment, value analysis/engineering, method analysis, operational analysis, etc. Work study has been utilized by companies to job productivity. Industrial engineering is the latest method employed to improve productivity. It deals with design, enhancement and setting up of engineering systems encompassing plants, machinery, workers, etc.

10. Learning objectives:

- i) Learn the basic concept of various productivities and work study in industrial manufacturing.
- ii) Learn the basic concept of Micro and Memo Motion Study.
- iii) Learn the basic concept of Work Measurement.
- iv) Learn the basic concept of different Ratings and Incentives.

11. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Understanding of various productivities and work study in industrial manufacturing.
 - ii) Understanding of Micro and Memo Motion Study.
 - iii) Understanding of the concept of Work Measurement.
 - iv) Understanding of different Ratings and Incentives.

12. Lab Content

Sr. No.	Title		
1	To Study the factors affecting the productivity using case study	i)	
2	To Study the human factor in work study using case study.	i)	
3	To study the Charts to record moments in shop operation using case study	ii)	
4	To Study the SIMO chart, and micro motion study using case study	ii)	
5	To Study the principles of motion economy using case study	ii)	
6	To study the areas of study under ergonomics using case study	iii)	
7	To study the Work measurement techniques using case study	iii)	

8	To study the Usability Engineering and Human Computer interface using	iii)
	case study	
9	To study the Method time measurement using case study	iv)
10	To study the Predetermined motion time study using case study	iv)

1. Name of th	e Department- Mechanica	al Engineering						
2. Course Name	Supply Chain and Logistic Management Lab	L T		T	Р			
3. Course Co	3. Course Code		0		0		2	
4. Type of Co	ourse (use tick mark)	Core () EAS ()		PE (✓) C		OE ())E ()	
5. Pre-requis	ite	6. Frequenc	y (use tick	Even	Odd	Either	Every	
(if any)		marks)		(✔)	0	Sem ()	Sem ()	
7. Total Num	ber of Lectures, Tutorials	, Practical (assu	ming 14 week	s of one s	emester)			
Lectures = 0		Tutorials = 0		Practi	cal = 28			
8. Course De	scription							
 that comprise the 9. Learning of i) An unde ii) An unde within ir iii) An unde iv) An unde 10. Course Ou i) Understa ii) Understa iii) Understa iii) Understa 	bjectives: erstanding of the primary dif erstanding of the individual adividual companies and activity erstanding of the management erstanding of the tools and te atcomes (COs): After the co anding the concept of Logistic anding the concept of Suppli- anding the concept Matching anding the concept of Strate	ferences between processes of sup ross the supply ch nt components of echniques useful is ompletion of the c tic Managements y Chain Managen g supply and dem	a logistics and ply chain mar nain. supply chain in implementin course, the stud ment nand	supply ch nagement a management ng supply	ain manag and their in ent. chain man	ement. nterrelati	onship	
Sr. No.	Title					CO: cove	s ered	
1	To Study the Multi-echelon system.					i)		
2	To Study the Logistics information system using case study.					i)		
3	To study the Supply chain management and logistics using case study.					ii)		
4	To Study the Supply Cha	ain drivers and ob	stacle using c	ase study.			ii)	
5 To Study the Demand management and aggregate planning using case study.					iii)			
5			ggregate plain	ing asing				

7	To study the Collaborative planning using case study	iii)
8	To study the uncertainty in supply chain using case study.	iv)
9	To study the Strategic lead-time management -using case study.	iv)
10	To study the economies of scale in supply chain cycle inventory using case study.	iv)

1. Name of the Department- Mechanical Engineering						
2. Course Name	Finite Element Methods Lab	L	Т		Р	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	PE	(✔)	OE	0
5. Pre-requisite (if any)		6. Frequenc y (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 00	Tutorials = 00	Practical = 28
8. Course Description		

The finite element method (FEM) is among one of the most powerful tool for the numeric solution of wide range of engineering problems. The application ranges from deformation and stress analysis of civil and mechanical structures, automotive components, aircraft designs, heat flux analysis, fluid flow problems, electrical magnetic flux problem. Upon completion, students should be able to solve the problems in solid mechanics and heat transfer using FEM.

9. Learning objectives:

- i) To enable the students, understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis.
- ii) To understand the characteristics of various finite elements.
- iii) To develop finite element equations for simple and complex domains.
- iv) To understand ANSYS and CAD tools.

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Apply the knowledge of mathematics and engineering to solve problems in structural and thermal engineering by approximate and numerical methods.
- ii) Design a new component or improve the existing components using FEA.
- iii) Solve the problems in solid mechanics and heat transfer using FEM.
- **iv**) Use commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life problems.

11. Lab Content

Sr. No.	Title	COs covered
1	Force and stress analysis using link elements in Trusses, cables etc.	i), ii), iii), iv)

2	Stress and deflection analysis in beams with different support conditions.	i), ii), iii), iv)
3	Stress analysis of flat plates and simple shells.	i), ii), iii), iv)
4	Stress analysis of axi-symmetric components.	i), ii), iii), iv)
5	Thermal stress and heat transfer analysis of plate.	i), ii), iii), iv)
6	Thermal stress analysis of cylindrical shells.	i), ii), iii), iv)
7	Vibration analysis of spring-mass systems.	i), ii), iii), iv)
8	Model analysis of beams.	i), ii), iii), iv)

2. Cour	se Name	Biomaterials Lab	L	Т		Р	
3. Cour	se Code		0	0		2	
4							
4. Туре	e of Course (use	e tick mark)				OE ()	
5. Pre-1	requisite (if		6. Frequency (use	Even	Odd (Either	Every
any)			tick marks)	(•)	Sem ()	Sem (
7. Tota	l Number of L	ectures, Tutorials, P	ractical (assuming 14 w	eeks of one	e semester	•)	
Lectures	= 0		Tutorials = 0	Practic	al = 28		
B. Cour	se Description						
oiotechno	· ·	gineering, medical im	s and design of biomate aging and clinical applic		for bioeng	gineering,	includin
			ants and their characteris		nlications		
viii) 10. Cour v) A vi) U vii) U viii)	To analy rse Outcomes (Able to investiga Understand the v Apply an	vze interface of biolog COs): On completion the the properties of b various analyzing pro- vast applications of th	gy and materials science of of this course, the stude	<u>with vast ap</u> nts will n of materia ries and pre	als. epare new	materials.	ue.
viii) 10. Cour v) A vi) U vii) U viii) 11. Lab	To analy rse Outcomes (Able to investiga Understand the v Apply an	vze interface of biolog COs): On completion the the properties of b various analyzing pro- vast applications of th	gy and materials science y of this course, the stude iomaterials. cesses for characterizatio ese material in the indust	<u>with vast ap</u> nts will n of materia ries and pre	als. epare new	materials.	
viii) 10. Cour v) A vi) U vii) U viii) 11. Lab	To analy rse Outcomes (Able to investiga Understand the v Apply an Content Title	ze interface of biolog COs): On completion ate the properties of b various analyzing pro- vast applications of th and account for method	gy and materials science y of this course, the stude iomaterials. cesses for characterizatio ese material in the indust	with vast ap nts will n of materia ries and pre- tions betwe	als. epare new en materia	materials. and tiss COs co	
viii) 10. Cour v) A vi) U vii) U viii) 11. Lab Sr. No.	To analy rse Outcomes (Able to investiga Understand the v Apply an Content Title To study surf materials.	vze interface of biolog COs): On completion ate the properties of bi- various analyzing pro- vast applications of the account for method	gy and materials science on of this course, the stude iomaterials. cesses for characterizatio lese material in the indust ds to characterize interact	with vast ap nts will n of materia ries and pre- tions betwe l properties	als. epare new en materia	materials. Is and tiss COs co	vered
viii) 10. Cour v) A vi) U vii) U viii) U viii) 11. Lab 5r. No. 1	To analy rse Outcomes (Able to investigat Understand the w Apply an Content Title To study surf materials. To investigat To investigat	vze interface of biolog COs): On completion inte the properties of bi- various analyzing pro- vast applications of the nd account for method face properties, physic e the structure, properties	gy and materials science of of this course, the stude iomaterials. cesses for characterizatio lese material in the indust ds to characterize interaction cal properties, mechanica	with vast ap nts will n of materia ries and pre- tions betwe l properties metal.	als. epare new en materia	materials. lls and tiss COs co	vered i)
viii) 10. Cour v) A vi) U vii) U viii) 11. Lab 5r. No. 1 2	To analy rse Outcomes (Able to investigat Understand the w Apply an Content Title To study surf materials. To investigat ceramic based	 vze interface of biolog COs): On completion nate the properties of biolog various analyzing provident of the properties of the discount for method account for method biomaterials. d the structure proper 	gy and materials science of of this course, the stude iomaterials. cesses for characterizatio lese material in the indust ds to characterize interactions cal properties, mechanica	with vast ap nts will n of materia ries and pre- tions betwe l properties metal. polymer, an	als. epare new en materia	materials. Is and tiss COs co i)	vered i) i)
viii) 10. Cour v) A vi) U vii) U viii) 11. Lab 5r. No. 1 2 3	To analy rse Outcomes (Able to investigat Understand the v Apply an Content Title To study surf materials. To investigat ceramic based To understan biomaterial d	 vze interface of biolog COs): On completion nate the properties of biolog various analyzing processing analyzing processing procesing processing processing processing proces	and materials science on of this course, the stude iomaterials. cesses for characterizatio lese material in the indust ds to characterize interaction cal properties, mechanica rties, and applications of rties, and applications of	with vast ap nts will n of materia ries and pre- tions betwe l properties metal. polymer, an	als. epare new en materia	materials. ls and tiss COs co i)	vered i) i) , ii)
viii) 10. Cour v) A vi) U vii) U viii) 11. Lab 5r. No. 1 2 3 4	To analy rse Outcomes (Able to investigat Understand the w Apply an Content Title To study surf materials. To investigat ceramic based To understan biomaterial d To study tech	 vze interface of biolog COs): On completion nate the properties of biolog various analyzing process vast applications of the account for method account for method 	gy and materials science on of this course, the stude iomaterials. cesses for characterizatio lese material in the indust ds to characterize interact cal properties, mechanica rties, and applications of rties, and applications of	with vast ap nts will n of materia ries and pre- tions betwe l properties metal. polymer, an and function ractions.	als. epare new en materia	materials. Is and tiss COs co i)	vered i) i) , ii) i)
viii) 10. Cour v) A vi) U vii) U viii) U viii) 11. Lab 5r. No. 1 2 3 4 5	To analy rse Outcomes (Able to investigat Understand the w Apply an Content Title To study surf materials. To investigat ceramic based To understan biomaterial d To study tech To learn abou To investigat	vze interface of biolog COs): On completion ate the properties of bi- various analyzing pro- vast applications of the nd account for method account for method	gy and materials science on of this course, the stude iomaterials. cesses for characterizatio lese material in the indust ds to characterize interaction ds to characterize interaction cal properties, mechanica rties, and applications of rties, and applications of ty-performance in design ure and Cell-Material Inter g and examination of cell mical structure can be use	with vast ap nts will n of materia ries and pre- tions betwe l properties metal. polymer, an and function ractions.	als. epare new en materia of nd on of	materials. ls and tiss COs co i) i) i), i)	vered i) i) , ii) i) iii)

9	To investigate how polymeric chemical structure can be used to control the	iii)
	degradation properties of the crosslinked network.	

5th Semester

1.	1. Name of the Department- Mechanical Engineering							
2.	Course	Fluid Mechanics	L	Т		P		
	Name	and Machines						
3.	3. Course Code		3		0		0	
4.	4. Type of Course (use tick mark)		Core (✓)	PE	0		OE ()	
5.	Pre-requisite	Engg. Maths &	6. Frequency	Eve	n ()	$Odd(\checkmark)$	Either	Every
		Engineering	(use tick marks)				Sem ()	Sem ()
		Mechanics						
7.	Total Number	of Lectures, Tutori	als, Practical (assum	ing 1 ⁴	4 wee	ks of one se	mester)	<u> </u>
Le	ctures = 42		Tutorials = 00		Prac	tical = 00		

8. Course Description:

Fluid mechanics and machinery is a branch of continuum mechanics that deals with the behavior of fluids (gases or liquids) either in motion or at rest and the subsequent effects of fluids upon boundaries, which may be either solid surfaces or interfaces with other fluids. This course deals fluids and their properties, and the kinematics and dynamics of fluid flow. After that students learn the fundamentals of flow through pipes, turbulent flow, dimensional analysis and boundary layers and their applications in engineering.

9. Learning Objectives:

- i) Understand fluid behavior for engineering design and control of fluid systems.
- ii) Develop competence with mass, energy and momentum balances.
- iii) Study the development of boundary layers and model similitude.
- iv) Study about various turbines and pumps designed on above concepts

10. Course Outcomes (COs):

- i) Understand the fundamental models for analyzing a fluid flow and fluid at rest both.
- ii) Find the dependent and independent parameters for a fluid flow.
- iii) Explain various methods available for boundary layer separation and analyze the model and prototype.
- iv) Understand the working principles of turbines and pumps

11. Unit wise detailed content

11. Unit wis	11. Unit wise detailed content						
Unit-1Number of lectures = 12Title of the unit: Fluid Properties and Hydrostatics							
Introduction to fluid mechanics, Fluid types and properties: Density, Viscosity, Surface tension, compressibility, capillarity, Fluid statics, Hydrostatic forces on plane, inclined and curved surfaces,							
buoyancy – centre of buoyancy, metacenter. Fluid Kinematics, Streamline and Velocity potential lines, stream function and potential function, Types of flows; Steady flow, Unsteady flow, Uniform and Non-Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows							
Unit - 2 Number of lectures = 10 Title of the unit: Fluid Dynamics							

Surface and Body forces-Euler and Bernoulli's equations and their applications, Momentum equation, Navier-Stokes Equations, Applications, force on pipe bend

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and parallel- total energy line- hydraulic gradient line

Measurement of flow- Venturi meter, orifice meter and Pitot tube

Unit - 3	Number of lectures = 09	Title of the unit: Boundary layers & Dimensional
		analysis

Boundary layers, Laminar flow and Turbulent flow, Boundary layer thickness, momentum, Integral equation, Drag and lift, Separation of boundary layer, Methods of separation of boundary layer. Dimensional homogeneity, Raleigh and Buckingham pi theorems, Non-dimensional numbers, Model laws and distorted models, Module quantities, Specific quantities

Unit - 4	Number of lectures = 11	Title of the unit: Turbo machines
Unit - 4	Number of lectures $= 11$	Title of the unit: Turbo machines

Basics of Turbo machinery: Impact of jets on stationary and moving flat and curved plates, concept of velocity diagram

Hydraulic turbines: Types and classification: Pelton, Francis and Kaplan turbines- work done, efficiency, work proportions and performance characteristic curves, draft tube design.

Pumps- Centrifugal and reciprocating pumps: work done, efficiency, work proportions and performance characteristic curves, pumps in series and parallel, Water hammer, NPSH.

Current Industrial applications of fluid flow analysis and fluid Machinery.

12. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended						
Text l	Book:					
i)	R. K. Bansal (2010), A Textbook of Fluid Mechanics and Hydraulic Machines, 9th Edition, Laxmi Publication (P) Ltd. New Delhi. ISBN- 978-8-131-80815-3.					

- i) Yunus A. Çengel (2010), Fluid Mechanics, Tata McGraw Hill, ISBN: 978-0-070-70034-5.
- ii) Frank M. White (2011), Fluid Mechanics, 7th edition, Tata McGraw-Hill Education, ISBN-978-0-071-33312-2.

1. Name of the Department- Mechanical Engineering						
2. Course Name	Kinematics of	L	Т		Р	
	Machines					
3. Course Code		3	0		0	
4. Type of Course (us	e tick mark)	Core (✓)	PE ()		OE ()	
5. Pre-requisite (if	+2 Level Physics	6. Frequency (use	Even ()	Odd	Either	Every
any)		tick marks)		(✔)	Sem ()	Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		Tutorials = 0	Practica	$\mathbf{l} = 0$		

8. Brief Syllabus

The analysis of a machine requires the determination of the movement or kinematics of its component parts, known as kinematic analysis. The assumption that the system is an assembly of rigid components allows rotational and translational movement to be modelled mathematically. This allows the position, velocity and acceleration of all points in a component to determine from these properties for a reference point and the angular position, angular velocity and angular acceleration of the component. Students learn Basics of Mechanisms, kinematic analysis of simple mechanisms, synthesis of simple mechanisms, kinematics of CAMS and kinematics of gears and gear trains.

9. Learning objectives:

- i) To familiarize students with basic types of mechanisms, joints and degrees of freedom to perform position, velocity and acceleration analysis using graphical and analytical methods.
- ii) To provide students an understanding of different types of mechanisms.
- iii) To teach the basics of synthesis of simple mechanisms.
- iv) To teach students the kinematic analysis of cam-follower motion and gears.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Demonstrate an understanding of the concepts of various mechanisms and pairs.
- ii) Conduct velocity and acceleration analysis of simple mechanisms.
- iii) Synthesize simple mechanisms for function, path generation and body guidance.
- iv) Design a layout of cam for specified motion and demonstrate an understanding of principles of operation of gears.

11. Unit wise detailed content

Unit-1	Number of	Title of the unit: Basics of Mechanisms		
	lectures = 10			

Introduction to Kinematics, Kinematic Link, Kinematic Pairs, Kinematic Chain, Mechanism vs Machine, Degree of Freedom Mobility, Kutzbach criterion, Grubler's criterion for planar mechanisms mechanism and Grashoff's law, Kinematic Inversions of 4-bar chain, Single slider and double slider crank chains, Quick return and its terminologies, Limiting positions, Mechanical advantage, Transmission angle.

Unit – 2 Number of Ti		Title of the unit: Kinematic Analysis of Simple Mechanisms			
	lectures = 10				
Displacement, velocity and acceleration analysis in simple mechanisms having turning, sliding and rolling pair, Coriolis acceleration using graphical relative motion method, Instantaneous center method, Four bar and slider crank mechanisms, Analytical method for four bar and slider crank mechanisms.					
Unit – 3 Number of Title of the unit: Synthesis of Simple Mechanisms					
Cint = 5	lectures = 10	The of the unit. Synthesis of Simple Mechanishis			

Classification of kinematic synthesis problems, two position synthesis of slider crank and crank rocker mechanisms, three position synthesis of double rocker mechanism, Chebychev spacing, Freudenstein analytical method, synthesis of function genera-tor using three precision positions, Graphical and analytical design of a four-bar linkage for body guidance, path generation by graphical method.

Unit – 4	Number of	Title of the unit: Kinematics of CAMS and Gears
	lectures = 12	

Types of cams and followers, Definitions related cam profile, Simple harmonic motion, Constant acceleration and deceleration, constant velocity, Cycloidal motion for knife edge and roller (in-line and offset). Spur gear terminology and definitions, Law of toothed and involute gearing, Interchangeable gears, Gear tooth action, Interference and undercutting, Basics of nonstandard gear teeth, Helical, Bevel, Worm, Rack and pinion gears, cycloidal tooth properties, Comparison of involute and cycloidal tooth forms.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Boo	13. Books Recommended				
Text B	Text Book				
i)	S.S. Rattan (2009), "Theory of Machines", 3 rd Edition, Tata McGraw-Hill. ISBN: 978-0-070-14477-4.				
Referen	nce Books:				
i)	A.Ghosh (2009), Theory of Mechanisms and Machines, 3 rd Edition, East-West Press Pvt. Ltd., New				
	Delhi, ISBN: 978-8-185-93893-6.				
ii)	Thomas Bevan (2009), Theory of Machines, 3 rd Edition, Pearson Education, ISBN: 978-8-131-72965-				
	6.				
iii)	Kenneth J Waldron and Gary L. Kinzel (2007), Kinematics, Dynamics, and Design of Machinery, 2 nd				
	Edition, John-Wiley and Sons Inc., New York, ISBN: 978-8-126-51255-3.				
iv)	J. Uicker John, Gordon R. Pennock Jr. and Joseph E. Shigly (2011), Theory of Machines and				
	Mechanisms, 4 th Edition, Oxford University Press, ISBN: 978-0-199-77781-5.				

Department Electives-V

2.	Course Nar	ne	Robotics Engineering and Applications	L		,	Г		P
3.	Course Cod	le		3			0		0
4.	Type of Co	urse	(use tick mark)	Core ()	PE (√)	OE ()	EAS ()	BSC ()
5.	Pre-requisit	te	NA	6. Frequency (use tick marks)	Even	u ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Numb	oer o	of Lectures, Tutorials,	Practical (assuming	14 week	ks of o	one semester	•)	
Le	ctures = 42			Tutorials = 0		Pract	tical = 0		
0	Course Des	or:	tone						
0	Learning O								
	 i) To fami manipul scenario ii) Make th iii) Enable t iv) Make th to variou Course Out 	iliari ator s. e stu he stu e stu 1s ro com	ze the students with kinematics & dynamic idents acquainted with tudents to acquire pract dents understand the in bots and their operatio	of this course, the learn	of Robo field of various	f robo otics Robot fields	tic system fo	or various	industria s.
	 i) To fami manipul scenario ii) Make th iii) Enable t iv) Make th to variou Course Out i) Understant 	iliari ator s. e stu he stu e stu 1s ro com and t	ze the students with kinematics & dynamic idents acquainted with tudents to acquire pract idents understand the in bots and their operation es (COs): At the end of	the theoretical aspects tical experience in the mportance of robots in nal details. of this course, the learn of robots.	of Robo field of various	f robo otics Robot fields	tic system fo	or various	industria s.
	 i) To fami manipul scenario ii) Make th iii) Enable t iv) Make th to variou Course Out i) Understa ii) Differen iii) Model f 	iliari ator s. e stu he stu is ro com and t tiate orwa	ze the students with kinematics & dynamic idents acquainted with tudents to acquire pract dents understand the in bots and their operatio es (COs): At the end of the basic components of types of robots and ro ard and inverse kinema	the theoretical aspects tical experience in the mportance of robots in nal details. of this course, the learn of robots. bot grippers. tics of robot manipulat	of Robo field of i various er will b	f robo otics Robot fields	tic system fo	or various	industria s.
10	 i) To famimanipul scenario ii) Make the iii) Enable to to variou iv) Make the to variou course Out ii) Understatii) Differentiii) Model for iv) Analyze 	lliari ator s. e stu he stu us ro com and t tiate orwa	the students with kinematics & dynamic idents acquainted with tudents to acquire practi- dents understand the in bots and their operation es (COs): At the end of the basic components of types of robots and ro- ard and inverse kinema tes in links and joints of	the theoretical aspects tical experience in the mportance of robots in nal details. of this course, the learn of robots. bot grippers. tics of robot manipulat	of Robo field of i various er will b	f robo otics Robot fields	tic system fo	or various	industria s.
10	 i) To fami manipul scenario ii) Make th iii) Enable t iv) Make th to variou Course Out i) Understa ii) Differen iii) Model fe iv) Analyze Unit wise de 	liari ator s. e stu he stu us ro com and t tiate orwa forc etail	the students with kinematics & dynamic idents acquainted with tudents to acquire practi- dents understand the in bots and their operation es (COs): At the end of the basic components of types of robots and ro- ard and inverse kinematic tes in links and joints of ed content	the theoretical aspects tical experience in the mportance of robots in nal details. of this course, the learn of robots. bot grippers. tics of robot manipulat of a robot.	of Robo field of various er will t	f robo otics Robot fields pe:	tic system fo	or various	industria s.
10 11 Un Int	 i) To famimanipul scenario ii) Make the scenario iii) Enable to to variou Course Out i) Understatii) Differentiii) Model for two scenarios iii) Model for two scenarios iiiii) Model for two scenarios iiiii) Model for two scenar	liiari ator s. e stu he si e stu is ro com and t tiate orw <i>a</i> forc etail umb	the students with kinematics & dynamic idents acquainted with tudents to acquire pract dents understand the in bots and their operatio es (COs): At the end of the basic components of types of robots and ro and inverse kinematic es in links and joints of ed content er of lectures = 10	the theoretical aspects tical experience in the mportance of robots in nal details. of this course, the learn of robots. bot grippers. tics of robot manipulat	ection of of Robo field of various er will b tors. Fundan	f robo otics Robot fields pe: nental	tic system for ics through of of engineeri s of Robotic fication of R	or various : case studie ng and exp	industria s. bose ther
10 11 Un Int	 i) To famimanipul scenario ii) Make th iii) Enable t iv) Make th to variou Course Out i) Understant ii) Different iii) Model for iv) Analyze Unit wise defited it-1 Notestant 	liiari ator s. e stu he stu as ro com and t tiate orwa forc etail umb	the students with kinematics & dynamic idents acquainted with tudents to acquire pract dents understand the in bots and their operatio es (COs): At the end of the basic components of types of robots and ro and inverse kinematic es in links and joints of ed content er of lectures = 10	the theoretical aspects tical experience in the mportance of robots in nal details. of this course, the learn of robots. bot grippers. tics of robot manipulat of a robot. Title of the unit: a robotic system, Typ	ection of of Robo field of various er will b tors. Fundan ees and Parallel M	f robo otics Robot fields oe: nental classif Manip	tic system for ics through of of engineeri s of Robotic fication of R ulator),	or various and exp case studie ng and exp c Systems Robots, app	s. pose then
10 11 Un Int Dr Gr gri	 i) To famimanipul scenario ii) Make the scenario iii) Enable to to variou iv) Make the to variou Course Out i) Understati ii) Differentiii) Model for the scenario of the scena	liari ator s. e stu he st e stu is ro com and t tiate orw <i>a</i> forc etail umb	ze the students with kinematics & dynamic idents acquainted with tudents to acquire practi- dents understand the in bots and their operation es (COs): At the end of the basic components of types of robots and ro- trypes of robots and ro- and inverse kinematic ed content er of lectures = 10 otics, Components of a control components (for er of lectures = 10 al Gripper, Grasping	the theoretical aspects tical experience in the mportance of robots in nal details. of this course, the learn of robots. bot grippers. tics of robot manipulat of a robot. Title of the unit: a robotic system, Typ Serial manipulator & P	ection of of Robo field of various er will b tors. Fundan Parallel M Robotic -factors-	f robo otics Robot fields pe: nental classif Manip classif	tic system for ics through of of engineeri s of Robotic fication of R ulator), ation and sp anisms for a	or various and exp case studie ng and exp c Systems Robots, app pecification actuation,	industria s. bose ther plication n Magneti

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogeneous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots

Unit - 4	Number of lectures = 12	Title of the unit: Robotic Navigation

Trajectory planning: Joint space scheme- Cubic polynomial fit-Obstacle avoidance in operation space-cubic polynomial fit with via point, bleeding scheme. Introduction Cartesian space scheme. Control- Interaction control, Rigid Body mechanics, Control architecture- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Industrial Robotics / Groover M P /McGraw Hill. (ISBN-10: 0071004424, ISBN-13: 978-0071004428)

- i) John J. Craig (2008), Introduction to Robotics: Mechanics and Control, 3rd Edition, Pearson Education. ISBN: 978-8-131-71836-0.
- ii) Theory of Applied Robotics /Jazar/Springer. (ISBN- 978-1-4419-1750-8)
- i) Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, (2010), Robotic Engineering an Integrated Approach, 1st Edition, Prentice-hall of India. ISBN: 978-8-120-30842-8.
- ii) S. R. Deb and Sankha Deb (2009), Robotics Technology and Flexible Automation, 2nd Edition, Tata McGraw-Hill Edu-cation. ISBN: 978-0-070-07791-1.
- iii) Robert Joseph Schilling (2007), Fundamentals of Robotics: Analysis and Control, Prentice Hall India. ISBN: 978-8-120-31047-6.

2.	Course Name	Solar and Nuclear Power Engineering	L	Т		Р		
3.	Course Code		3	0		0		
4.	Type of Course (u	se tick mark)	Core ()	PE (✔)		OE ()		
5.	Pre-requisite (if any)	Engineering Thermodyna mics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every ()	Sem

Lectures = 42	Tutorials = 0	Practical = 00
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8. Brief Syllabus

The combination of continual nuclear power with solar energy stored in the salts allows the reactor to generate super-heated steam to run electricity even at night. Studies predict solar-nuclear hybrid power plants to be far more efficient in power generation compared to nuclear or solar power plants alone. Solar energy systems include collectors to convert solar radiation to heat in a fluid, energy storage units which are designed to accumulate energy when it is available and deliver it when needed, means to deliver the energy from the storage to a load, and necessary pumps, controls, etc. On the other hand Nuclear Power Engineering concentrates on the principles, techniques and processes involved in generation of power from nuclear fuels. This involves studying and exploring various aspects of science ranging from processing of nuclear fuel to merits and demerits of various nuclear reactors and from reprocessing of nuclear waste to their safely disposal. Upon completion of this course students will be able to have better understanding of nuclear processes involved in nuclear power generation, know working and pros & cons of various reactors and also have understanding of nuclear waste disposal.

9. Learning objectives:

- i) The student will be exposed to the basic physics of solar energy system and applications of solar based energy equipment.
- ii) The student will be exposed to the basic physics of nuclear reactions and operation of nuclear reactors.
- iii) To learn the working and various type of Reprocessing
- iv) To learn various types of power generation methods, safety and its impact on environment.

10. Course Outcomes (COs):

- i) Know the fundamentals of solar energy systems operations.
- ii) Aware to the concept of solar thermal and photovoltaic operating systems and to Know the nuclear fission and fusion processes.
- iii) Understand the working of Reprocessing
- iv) Understand the working of nuclear reactors and understand power generation and safety aspects.

11. Unit wise detailed content					
Unit-1	Number of lectures = 12	Title of the unit: Fundamentals of Solar energy system			
T . 1 .! T	1 1 1 1				

Introduction, Energy science and Technology, Forms of Energy, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Roles and responsibility of Ministry of New and Renewable Energy Sources, Needs of renewable energy, Classification of Energy Resources, Conventional Energy Resources, Nonconventional Energy Resources, World Energy Scenario, Indian Energy Scenario.

Introduction to Solar Radiation, Sun path diagram, Basic Sun-Earth Angles, Solar Radiation Geometry and its relation, Measurement of Solar Radiation on horizontal and tilted surfaces, Principle of Conversion of Solar Radiation into Heat, Collectors, Collector efficiency, Selective surfaces, Solar Water Heating system, Solar Cookers, Solar driers, Solar Still, Solar Furnaces, Solar Green Houses. Solar Photovoltaic, Solar Cell fundamentals, Characteristics, Classification, Construction of module, panel and array. Solar PV Systems (stand-alone and grid connected), Solar PV Applications. Government schemes and policies.

Unit – 2	Number of	Title of the unit: Nuclear Reactors and Reactor
	lectures = 08	Materials

Mechanism of nuclear fission – Nuclides - Radioactivity – Decay chains - Neutron reactions - Fission process – Reactors - Types of reactors – Design and construction of nuclear reactors - Heat transfer techniques in nuclear reactors - Reactor shielding.

Nuclear fuel cycles – Characteristics of nuclear fuels – Uranium – Production and purification of uranium – Conversion to UF4 and UF6 – Other fuels like Zirconium, Thorium, Berylium.

Unit – 3	Number of	Title of the unit: Reprocessing
	lectures = 08	

Nuclear fuel cycles - Spent fuel characteristics - Role of solvent extraction in reprocessing - Solvent extraction equipment.

Unit – 4	Number of	Title of the unit: Separation of Reactor Products
	lectures = 14	and Waste Disposal and Radiation Protection

Processes to be considered - Fuel element dissolution - Precipitation process – Ion exchange - Redox - Purex - TTA – Chelation -U235 -Hexone - TBP and Thorax processes - Oxidative slagging and electro-refining - Isotopes – Principles of isotope separation.

Types of nuclear wastes – Safety control and pollution control and abatement - International convention on safety aspects – Radiation hazards prevention. Unit of Nuclear Radiation, Effects of Nuclear Radiation, Radioactive Waste Disposal System, Gas Disposal System.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Books

- i) Janet Wood (2007), Nuclear Power, Institution of Engineering and Technology. ISBN: 978-0-863-41668-2.
- **ii**) Samuel Glasstone, Alexander Sesonske (2012), Nuclear Reactor Engineering: Reactor Systems Engineering, 4th Edition, CBS Publisher. ISBN: 978-1-461-35866-4.
- iii) J. Kenneth Shultis, Richard E. Faw, Marcel Dekker (2002), Fundamentals of Nuclear Science and Engineering, Marcel Dekker. ISBN: 978-0-824-70834-4.

i)	Samuel Glasstone (1994), Nuclear Reactor Engineering: Reactor Design Basics, Volume-1,
	4th Edition, Kluwer Academic Publishers. ISBN: 9780412985218

- A.E. Walter and A.B. Reynolds (1981), Fast Breeder Reactor, Pergamon Press, ISBN: 978-0-080-25982-6.
- iii) D. Y. Goswami, Principles of Solar Engineering, Third Edition, CRC Press, Taylor and Francis, 2015. ISBN- 13: 978-1-4665-6379-7.
- iv) Garg and Prakash, Solar Energy, Fundamentals and Applications, Tata McGraw Hill, 2017. ISBN-13: 978-0074631416.
- v) Solar energy : principles of thermal collection and storage, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., 1997. ISBN- 0074624539 9780074624531.

2.	Name of t	he Department- Mechanical E	ngineering				
	Course Name	Rapid Manufacturing Technologies	L		Т		Р
3.	Course Code		3		0		0
4.		ourse (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
	Pre- requisit e (if any)	Material Engineering & Technology	6. Frequency (use tick marks)	Even ()	Odd (🗸)	Either Sem ()	Every Sem ()
7.	Total Nui Lectures	nber of Lectures, Tutorials, Pr = 42	actical (assuming Tutorials = 0		cone semest ical = 0	er)	
8.	Course D	escription					
	 i) To Le ii) To De iii) To Ac iv) To far 	objectives: Students undergoing arn the Rapid Manufacturing Te- sign, Development and Manufac quaint the Concept of Additive I niliarize with the Rapid Manufac	chnologies. cturing using Rapid Manufacturing Tec	Manufactur	d Material s	election for	
10.	i) To unii) To un	utcomes (COs): On course com derstand various Rapid manufac derstand the use of techniques for derstand the use of rapid manufa	turing technologies or processing of CA	D models fo		otyping.	
	 i) To un ii) To un iii) To un iv) Under 	derstand various Rapid manufact derstand the use of techniques for derstand the use of rapid manufa stand and apply fundamentals of	turing technologies or processing of CA cturing technology	D models fo in reverse e		otyping.	uics.
11.	 i) To un ii) To un iii) To un iv) Under 	derstand various Rapid manufac derstand the use of techniques for derstand the use of rapid manufa	turing technologies or processing of CA cturing technology	D models fo in reverse e techniques.	ngineering.		
11. U Intr Ma Ma	 i) To un ii) To un iii) To un iv) Under Unit wise nit-1 	derstand various Rapid manufac derstand the use of techniques for derstand the use of rapid manufa stand and apply fundamentals of detailed content	turing technologies or processing of CA acturing technology f rapid prototyping Title of the unit: omization and M we/Formative, Pro	D models for in reverse en techniques. Introduction ass Custom cess Chain nufacturing,	ngineering. on to rapid r ization, Cla for Additiv challenges ir	manufactu Issification ve and Ot 1 rapid man	ring of Rapid her Rapid ufacturing.
11. U Intr Ma Ma U Pre Ger pro Imp	 i) To un ii) To un iii) To un iv) Under Unit wise Unit wise Init-1 	derstand various Rapid manufact derstand the use of techniques for derstand the use of rapid manufact stand and apply fundamentals of detailed content Number of lectures = 10 o Rapid Manufacturing, Cust g Processes (Additive/Subtraction g Processes, Advantages and limit	turing technologies or processing of CA acturing technology frapid prototyping Title of the unit: omization and M ave/Formative, Pro- tations of rapid man Title of the unit: manufacturing nversion to STL file ration of Tool Pat rovement in Surface	D models for in reverse entropy techniques. Introduction ass Custom cess Chain nufacturing, Pre and po e, Diagnosis n Pattern and e Finish, Imp	ngineering. on to rapid r ization, Cla for Additiv challenges ir st processin of STL file I d Internal H	manufactu assification ve and Ot a rapid man ag in additi Error, Part o latching Pa	ring of Rapid her Rapid ufacturing. ve orientation, ittern, Post

Vat photopolymerization based, powder bed fusion based, extrusion based, material jetting based, binder jetting based, direct energy deposition based and sheet lamination based additive manufacturing processes, Process parameters, Advantages, disadvantages, and materials for different additive manufacturing processes.

Unit – 4	Number of lectures = 8	Title of the unit: Additive and other Rapid manufacturing
		case study

Case study of additive manufacturing processes: In medical, in automobile sector, in defense, in aerospace and in other fields like arts, fashion and jewelry.

Rapid Manufacturing Processes: Subtractive, Rapid Manufacturing Processes: Formative, Process selection, Applications and Case studies

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Bo	13. Books Recommended					
Text B	ook					
i)	Gibson, I., Rosen, D., Stucker, B. (2016), "Additive Manufacturing Technologies: 3D Printing, Rapid					
	Prototyping, and Direct Digital Manufacturing", Germany: Springer New York, ISBN:					
	9781493944552, 149394455X					
Refere	ence Books					
i)	Gebhardt, A. (2012). Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling,					
	Rapid Manufacturing. Germany: Hanser Publications, ISBN: 9783446425521, 3446425527					
ii)	Hötter, J., Gebhardt, A. (2016), "Additive Manufacturing: 3D Printing for Prototyping and					
	Manufacturing", Germany: Hanser Publications, ISBN: 9781569905821, 1569905827					
iii)	Cooper, K. (2001), "Rapid Prototyping Technology: Selection and Application", United States: Taylor					
	& Francis, ISBN: 9780824745240, 0824745248					

	Course Name	Design for Manufacture & Assembly	L	T			Р	
3.	Course Code		3		0	0		
4. Type of Course (use tick mark)			Core ()	PE OE () (✓) (✓)		Specialization 0		
5.	Pre-requisite (if any)	Design for Mechanical Elements	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem (
		Lectures, (assuming 14 weeks		-				
Le	ctures = 42		Tutorials = 0	Practio	cal = 0			
8	Course Descripti	on	1					
	Ĩ	facturing & assembly is challeng	ing subject that inc	ludos das	ion nrinci	nles for		
	•	• • •	• •		U I	•		
	-	Influencing factors on Design. T		-	-			
		esign. The aim of present course					-	
pro	cess with general c	lesign principles which based on	different aspects of	f manufa	cturing as	well assen	nbly.	
	T • 1 • /•							
9.	Learning objecti							
	i) To study varie	ous factors influencing the manu	facturability of com	ponents.				
	ii) To impart kno	owledge about factors that influen	nce changes in prod	lugt dogie				
		when the set we want the set of t	nee enanges in proc	iuci desig	gn.			
	iii) To study appl	-		-	gn.			
		ications of various casting, forgin		-	gn.			
10	iv) To study life	ications of various casting, forgin cycle assessment of the product.	ng and welding pro	cesses	ın.			
10	iv) To study life ofCourse Outcome	ications of various casting, forgin cycle assessment of the product. s (COs): On course completion	ng and welding pro	cesses e to				
10	iv) To study life (Course Outcomei) Get to know a	ications of various casting, forgin cycle assessment of the product. (COs): On course completion subout various internal and external	ng and welding pro students will be abl al characteristic of p	cesses e to		lesign.		
10	 iv) To study life of Course Outcome i) Get to know a ii) To know gene 	ications of various casting, forgin cycle assessment of the product. s (COs): On course completion s about various internal and externa- eral design principles for manufa	ng and welding pro students will be abl al characteristic of r cturability.	cesses e to material a	affecting d	-		
10	 iv) To study life of Course Outcome i) Get to know a ii) To know gene 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion subout various internal and external	ng and welding pro students will be abl al characteristic of r cturability.	cesses e to material a	affecting d	-	esses lik	
10	 iv) To study life of Course Outcome i) Get to know a ii) To know gene 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion s about various internal and externa- eral design principles for manufa- of basic design process based on c	ng and welding pro students will be abl al characteristic of r cturability.	cesses e to material a	affecting d	-	esses lik	
10	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion a about various internal and externa- eral design principles for manufa- of basic design process based on o rilling etc.	ng and welding pro students will be abl al characteristic of r cturability. different aspects of	cesses e to material a different	affecting d	-	esses lik	
	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion s about various internal and externa eral design principles for manufa- of basic design process based on o illing etc. have idea about various phases in	ng and welding pro students will be abl al characteristic of r cturability. different aspects of	cesses e to material a different	affecting d	-	esses lik	
11	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion a about various internal and externa- eral design principles for manufa- of basic design process based on o rilling etc. have idea about various phases in d content	ng and welding pro students will be abl al characteristic of r cturability. lifferent aspects of the life of a produc	cesses e to material a different ct.	uffecting d manufactu	-	esses lik	
11	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion s about various internal and externa eral design principles for manufa- of basic design process based on o illing etc. have idea about various phases in	ng and welding pro students will be abl al characteristic of r cturability. different aspects of	cesses e to material a different ct.	uffecting d manufactu	-	esses lik	
11 Un	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion s about various internal and externa- eral design principles for manufa- of basic design process based on o illing etc. have idea about various phases in d content Number of lectures = 12	ng and welding pro students will be abl al characteristic of r cturability. different aspects of the life of a produce Title of the unit	cesses e to material a different et. : Introdu	offecting d manufactu	aring proce		
11 Ur Str	 iv) To study life (Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed iit-1 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion s about various internal and externa- eral design principles for manufa- of basic design process based on o illing etc. have idea about various phases in d content Number of lectures = 12 cal factors, mechanisms selection	ng and welding pro students will be abl al characteristic of r cturability. different aspects of the life of a produc Title of the unit n, evaluation metho	cesses e to material a different ct. : Introdu d, Proces	uffecting d manufactu uction	aring proce		
11 Ur Str	 iv) To study life (Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed iit-1 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion s about various internal and externa- eral design principles for manufa- of basic design process based on o illing etc. have idea about various phases in d content Number of lectures = 12	ng and welding pro students will be abl al characteristic of r cturability. different aspects of the life of a produc Title of the unit n, evaluation metho	cesses e to material a different ct. : Introdu d, Proces	uffecting d manufactu uction	aring proce		
11 Ur Str tol	 iv) To study life (Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed iit-1 	ications of various casting, forgin cycle assessment of the product. (COs): On course completion s about various internal and externa- eral design principles for manufa- of basic design process based on o illing etc. have idea about various phases in d content Number of lectures = 12 cal factors, mechanisms selection	ng and welding pro students will be abl al characteristic of r cturability. different aspects of the life of a produc Title of the unit n, evaluation metho	cesses e to material a different et. : Introdu d, Proces olerance	affecting d manufactu netion ss capabili stacks.	uring proce	, ,	
11 Ur Str tol Ur	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed it-1 ength and mechani erances, Geometric iit – 2 orking principle, M 	ications of various casting, forgin cycle assessment of the product. Is (COs): On course completion subout various internal and externate and design principles for manufactorial design principles for manufactorial of basic design process based on or illing etc. have idea about various phases in d content Number of lectures = 12 cal factors, mechanisms selection tolerances, Assembly limits, Da	ng and welding pro students will be abl al characteristic of r cturability. different aspects of the life of a produc Title of the unit n, evaluation metho tum features, and T Title of the unit ssible solutions, M	cesses e to material a different ct. : Introdu d, Proces 'olerance : Factors	affecting d manufactu iction stacks.	ty: Feature		
11 Ur Str tol Ur Wo	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed it-1 ength and mechani erances, Geometric iit – 2 orking principle, M 	ications of various casting, forgin cycle assessment of the product. s (COs): On course completion s about various internal and externa- eral design principles for manufa- of basic design process based on of illing etc. ave idea about various phases in d content Number of lectures = 12 cal factors, mechanisms selection tolerances, Assembly limits, Da Number of lectures = 10 aterial, Manufacture, Design- Po	ng and welding pro students will be abl al characteristic of r cturability. different aspects of the life of a produc Title of the unit n, evaluation metho tum features, and T Title of the unit ssible solutions, M	cesses e to material a different ct. : Introdu d, Proces 'olerance : Factors aterials c	affecting d manufactu iction s capabili stacks.	ty: Feature ing Design		
11 Ur Str tol Ur Wo on	 iv) To study life of Course Outcome i) Get to know a ii) To know gene iii) Introduction of machining, dr iv) Student will h Unit wise detailed it-1 ength and mechani erances, Geometric iit – 2 orking principle, M form design, form 	ications of various casting, forgin cycle assessment of the product. is (COs): On course completion is about various internal and externa- eral design principles for manufa- of basic design process based on or illing etc. have idea about various phases in d content Number of lectures = 12 cal factors, mechanisms selection tolerances, Assembly limits, Da Number of lectures = 10 aterial, Manufacture, Design- Po design of Welded members, forg	ng and welding pro students will be abl al characteristic of r cturability. different aspects of the life of a produce Title of the unit n, evaluation metho tum features, and T Title of the unit ssible solutions, M ings and castings.	cesses e to material a different ct. : Introdu d, Proces olerance : Factors aterials c. : Compo	affecting d manufactu netion ss capabili stacks. Influenc hoice, Infl nent Desi	ty: Feature ing Design uence of r gn-I	n naterial:	

amalgamation, Design for machinability, Design for economy, Design for clampability, Design for accessibility, Design for assembly.

Unit – 4	Number of lectures = 10	Title of the unit: Component Design-II

Casting Consideration: Redesign of castings based on parting line considerations, minimizing core requirements, machined holes, re-design of cast members to obviate cores. Identification of uneconomical design, Modifying the design, group technology, Computer Applications for DFMA. Recent trends and some promising techniques for designing a component for manufacturing.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

i) Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004, ISBN-13 978-: 0130212719

- i) Product design and development, by K.T. Ulrich and S.D. Eppinger, Tata McGraw Hill, ISBN 9780070146792
 ii) Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994, ISBN 978-
 - 0824791766

•	Name of u	e Department- Mecha	incal Engineering				
2.	Course	Advanced	L		Т		Р
	Name	Automotive					
		Electronics					
3.	Course		3		0		0
	Code						
4.	Type of Co	ourse (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5.	Pre-	Basics of	6. Frequency	Even ()	Odd (✔)	Either	Every Sen
	requisite	Automobile	(use tick			Sem ()	0
	(if any)	Engineering	marks)				
7.	Total Num	ber of Lectures, Tutor	ials, Practical (assu	iming 14 w	eeks of one so	emester)	ł
	Lectures =	= 42	Tutorials = 0	Prac	tical = 0		
8.	Course De	scription		1			
Au	tomotive ele	ctronics are electronic s	ystems used in vehic	cles, includi	ng engine ma	nagement, ig	gnition,
		, telematics, in-car enter					-
	-	also found in trucks, mo	•	-	-		
		as forklifts, tractors, an	-				-
	-	brid vehicles and electri		a cienients			ethear system
	-		c cais as well.				
9.	Learning o	-				manda Anta	
		erstand the concepts of A	Automotive Electron	ics and its e	volution and t	rends, Auto	motive system
		ystems overview.					11.00
		erstand sensors and sen	e		•	•	tems, differen
	-	conditioning techniques,					
	iii) To und	erstand, design and mod	lel various automoti	ive control s	ystems using	Model base	d developme
	techniq	ue.					
	iv) To unde	erstand role of Microcon	trollers in ECU desi	gn and choic	e of appropria	ate Hardwar	e and Softwar
10.	Course Ou	tcomes (COs): On cour	se completion stude	ents will be a	ble to		
	i) Develo	p, simulate and integrate	e control algorithms	for ECUs w	vith hardware		
		e automotive sensors ar	-				
	iii) Obtain	an overview of automo	tive components, s	ubsystems.	lesign cycles	. communic	ation protoco
		ety systems employed ir	—		8	,	r
		be various communication			protocols used	l in vehicle r	networking
11		letailed content	in systems, whet a		lotocols used		letworking.
11.		ictancu content					
T	'nit 1	Number of lectures	Title of the unit.	Engino/Voh	iolo Soncora	& Digital F	nging Contr
U	nit-1	Number of lectures	Title of the unit:	Engine/Veh	icle Sensors	& Digital E	ngine Contr
		= 12	System				
Intr	roduction, ba	= 12 asic sensor arrangement,	System , types of sensors, o	oxygen senso	ors, fuel mete	ring/vehicle	speed sensor
Intr det	roduction, ba	= 12 asic sensor arrangement, or. Flow sensor. Throttle	System , types of sensors, c e position sensors. S	oxygen senso Solenoids, st	ors, fuel mete epper motors	ring/vehicle , and relays.	speed sensor Open loop ar
Intr det clos	roduction, ba onation sens se loop cont	= 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Cont	System , types of sensors, c e position sensors. S trol Module (ECM)	oxygen senso Solenoids, st , engine coo	ors, fuel mete epper motors ling and warr	ring/vehicle , and relays. n up control	speed sensor Open loop ar I, Acceleratio
Intr det clos det	roduction, ba onation sens se loop cont onation and	= 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Cont idle speed control-integ	System , types of sensors, c e position sensors. S trol Module (ECM) grated engine syste	oxygen senso Solenoids, st , engine coo m, exhaust	ors, fuel mete epper motors ling and warr	ring/vehicle , and relays. n up control	speed sensor Open loop ar I, Acceleratio
Intr det clos det	roduction, ba onation sens se loop cont onation and	= 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Cont	System , types of sensors, c e position sensors. S trol Module (ECM) grated engine syste	oxygen senso Solenoids, st , engine coo m, exhaust	ors, fuel mete epper motors ling and warr	ring/vehicle , and relays. n up control	speed sensor Open loop ar I, Acceleratio
Intr det clos det dia	roduction, ba onation sens se loop cont onation and	= 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Cont idle speed control-integ	System , types of sensors, c e position sensors. S trol Module (ECM) grated engine syste	oxygen senso Solenoids, st , engine coo m, exhaust ms	ors, fuel mete epper motors ling and warr emission con	ring/vehicle , and relays. n up control atrol enginee	speed sensor Open loop ar l, Acceleratio ering, on-boa
Intr det clos det dia	roduction, ba onation sens se loop cont onation and gnostics, dia	= 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Cont idle speed control-integ gnostics, future automot	System , types of sensors, c e position sensors. S trol Module (ECM) grated engine syste tive electronic syste	oxygen senso Solenoids, st , engine coo m, exhaust ms	ors, fuel mete epper motors ling and warr emission con	ring/vehicle , and relays. n up control atrol enginee	speed sensor Open loop ar l, Acceleratio ering, on-boa
Intr det clos det dia U	roduction, ba onation sens se loop cont onation and gnostics, dia nit - 2	= 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Cont idle speed control-integ gnostics, future automot Number of lectures	System types of sensors, of position sensors. So trol Module (ECM) grated engine syste tive electronic syste Title of the unit:	oxygen senso Solenoids, st , engine coo m, exhaust ms Electronic 1	ors, fuel mete epper motors ling and warr emission con F uel Injectio	ring/vehicle , and relays. n up control atrol enginee n and Igniti	speed sensor Open loop ar l, Acceleratio ering, on-boa on system
Intr det clos det dia U	roduction, base on ation sense loop control on and gnostics, dia $rac{1}{1}$ on the formula of	 = 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Control-integenostics, future automote Number of lectures = 10 edback carburettor system 	System , types of sensors, of e position sensors. Second Module (ECM), grated engine syste tive electronic syste Title of the unit: em (FBC), types of g	oxygen senso Solenoids, st , engine coo m, exhaust ms Electronic l	ors, fuel mete epper motors ling and warr emission con Fuel Injection injection syst	ring/vehicle , and relays. n up control trol enginee n and Igniti em, Throttle	speed sensor Open loop ar l, Acceleratio ering, on-boa on system
Intr det clos det dia U U Intr and	roduction, ba onation sens se loop cont onation and gnostics, dia finit - 2 roduction, fea 1 multi-port	= 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Control- idle speed control-integ gnostics, future automote Number of lectures = 10 edback carburettor system of point fuel injection,	System , types of sensors, of e position sensors. So trol Module (ECM) grated engine syste tive electronic syste Title of the unit: em (FBC), types of g injection system co	oxygen senso Solenoids, st , engine coo m, exhaust ms Electronic l gasoline fuel ontrol. Robe	ors, fuel mete epper motors ling and warr emission con Fuel Injection injection syst	ring/vehicle , and relays. n up control trol enginee n and Igniti em, Throttle	speed sensor Open loop ar l, Acceleratio ering, on-boa on system
Intr det det dia U Intr and con	roduction, ba onation sens se loop cont onation and gnostics, dia init - 2 roduction, fea 1 multi-port ntrols. Fuel a	 = 12 asic sensor arrangement, or. Flow sensor. Throttle rol system, Engine Control-integenostics, future automote another of lectures = 10 edback carburettor system 	System types of sensors, of e position sensors. So trol Module (ECM), grated engine syste tive electronic syste Title of the unit: em (FBC), types of g injection system co charged engine fuel	oxygen senso Solenoids, st , engine coo m, exhaust ms Electronic l gasoline fuel ontrol. Robe	ors, fuel mete epper motors ling and warr emission con Fuel Injection injection syst rt Bosch gase	ring/vehicle , and relays. n up control atrol enginee n and Igniti em, Throttle oline fuel in	speed sensor Open loop ar l, Acceleratio ering, on-boa on system body injection ajection system

Unit – 3	Number of lectures	Title of the unit: Warning and alarm instruments
	= 10	
Brake actuation	warning system, trafica	tors, flash system, oil pressure warning system, engine over heat warning
system, air pres	sure warning system, s	peed warning system, door lock indicators, gear neutral indicator, horn
design, permane	ent magnet horn, air & r	nusic horns.
Unit – 4	Number of lectures	Title of the unit: Dash board amenities, Comfort and Safety
	= 10	
Car radio and	stereo, courtesy lamp,	time piece, cigar lamp, car fan, wind shield wiper, window washer,
instrument wir	ing system and electro	omagnetic interference suppression, wiring circuits for instruments,
electronic instru	ments, dash board illun	nination.
seats, mirrors an	nd sun-roofs, central loc	king and electronic windows, cruise control, in-car multimedia, security,
airbag and belt	tensioners, other safe	ty and comfort systems, advanced comfort and safety systems, new
developments in	n comfort and safety, the	e system approach to control & instrumentation, Antilock braking system
(ABS). Electron	nic Ride Microprocessor	control.
12. Brief Descr	ription of self-learning	/ E-learning component
The students wi	ll be encouraged to learn	n using the SGT E- Learning portal and choose the relevant lectures
delivered by sul	oject experts of SGT Un	iversity.
	E-Learning portal.	
http://agtlma.org	*	

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Robert N. Brandy, "Automotive Computers & Digital Instrumentation", Prentice Hall Eaglewood, Cliffs, Reston Pub Co, ISBN: 0835902633

- i) Wiliam B. Ribbens- Understanding Automotive Electronics, Allied Publishers Pvt. Ltd., 5th Revised Edition, ISBN: 0750670088.
- ii) Tom Denton- Automobile Electrical & Electronic Systems, Allied Publishers Pvt. Ltd., 3rd Edition, 2004, ISBN: 0768014972

2.	Course Name	Mechatronics Systems and Its Applications	L		Τ		Р
3.	Course Code		3		0		0
4.	Type of Co mark)	urse (use tick	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5.	Pre- requisite (if any)	Applied Physics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Num Lectures =	ber of Lectures, Tute 42	orials, Practical (ass Tutorials = 0		eeks of one s tical = 0	semester)	
8.	Course Des	scription					
engi engi ust and	ineering, cor ineering, that included the electronics;	a design process t ntrol engineering and t is to say, it rejects sp combination of mech however, as technica g recent years to inclu	computer engineeri blitting engineering i nanics and electronic l systems have becc	ng. Mechatr nto separate s, hence the ome more an	onics is a m disciplines. (word is a co	nultidisciplinar Driginally, mean mbination of a	y field of chatronics mechanics

- ii) To provide knowledge of sensors, actuators and their selection for an application.
- iii) To expose interfacing of devices with controllers.
- iv) To understand the Intelligent Mechatronics.

10. Course Outcomes (COs): On course completion students will be able to

- i) Identify the elements of mechatronics system.
- ii) Select suitable sensors and actuators to meet specific requirements.
- iii) Select the controllers according to the need.
- iv) Demonstrate intelligent mechatronics system for engineering applications.

11. Unit wise detailed content

Unit-1	Number of Title of the unit: Introduction to Mechatronics			
	lectures = 10			
Introduction to	o Mechatronics - C	onventional and Mechatronics approach in designing products -		
Mechatronics d	lesign process –Mecha	atronics in manufacturing – Adaptive and distributed control systems –		
Modeling and s	simulation of Mechatro	onics Systems.		
	1	r		
Unit – 2	Number of	Title of the unit: Microprocessor		
	lectures = 10			

Architecture of microprocessor and microcontroller – System interfacing for a sensor, keyboard, display and motors – Application cases for temperature control, warning and process control systems.

Unit – 3	Number of	Title of the unit: Programmable Logic Controllers
	lectures = 12	

Architecture of Programmable Logic Controllers – Input/Output modules – Programming methods – Timers and counters – Master controls – Branching – Data handling – Analog input/output – Selection of PLC and troubleshooting.

Unit – 4	Number of	Title of the unit: Intelligent Mechatronics and Case Studies
	lectures = 10	

Fuzzy logic control and Artificial Neural Networks in mechatronics – Algorithms – Computer-based instrumentation – Real-time Data Acquisition and Control – Software integration – Man-Machine Interface – Vision system – Mechatronics system case studies.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

i) W. Bolton (2008), Mechatronics - Electronic Control Systems in Mechanical and Electrical Engineering, 4th Edition, Prentice Hall. ISBN: 978-0-273-74286-9.

- i) Devdas Shetty and Richard A. Kolk (2012), Mechatronics System Design, 2nd Edition, C. L. Engineering, ISBN: 978-8-131-51828-1.
- **ii**) Michael B. Histand and David G. Alciatore (2005), Introduction to Mechatronics and Measurement systems, McGraw- Hill. ISBN: 978-0-070-64814-2
- iii) B.P. Singh (2006), Advanced Microprocessor and Microcontrollers, New Age International Publisher.ISBN: 978-8-122-41956-6.
- **iv**) A. Smaili and F. Mrad (2008), Mechatronics: Integrated Technologies for Intelligent Machines, 1st Edition, Oxford University Press. ISBN: 978-0-198-06016-1.

1. Name of the Depart	tment- Mechanical E	ngineering				
2. Course Name	Introduction to	L]	Г	l	P
	Electric and					
	Hybrid Vehicles					
3. Course Code		3	()	()
4. Type of Course (use	e tick mark)	Core ()	PE (✓)		OE ()	
5. Pre-requisite (if	Basics of	6. Frequency (use	Even ()	Odd	Either	Every
any)	Automobile	tick marks)		(✔)	Sem ()	Sem ()
	Engineering					
7. Total Number of Lo	ectures, Tutorials, P	ractical (assuming 14 wee	ks of one	semester)	
Lectures = 42		Tutorials = 0	Practica	l = 0		
8. Course Description						
This course introduces the	e fundamental concep	ots, principles, analysis and	design of	hybrid an	d electric	vehicles.
The material for this cou	urse will be prepared i	n such a manner that it wi	ll be usefu	l for post	-graduate	students,
teachers, practitioners an					0	
9. Learning objectives	s:					
		pplications of the concepts	s of Hybri	d electric	vehicles.	
		Electric Vehicle motors	·			
<i>'</i>	control in Electric Ve	hicles.				
iv) Know about the						
		completion of this course,	the studen	t will be a	ble to:	
	working principle of e					
		principle of various motors				
		f electronics and sensor les ng principle of hybrid vehi		in electric	venicles	
11. Unit wise detailed c	· ·	ing principle of hybrid vehi	icies.			
Unit-1 Number of Title of the unit: Introduction to Electric Vehicles						
	lectures = 10	The of the unit. Introd			enteres	
Electric Vehicle – Need		Emissions – End of life. E	lectric Ve	ehicle Tec	hnology –	- lavouts.
	• •	verview and its types. Bat				-
-		charging sources – Wireles				apartiri,
Unit – 2	Number of	Title of the unit: Electri				
	lectures = 12					
Motors (DC Induction		ciple, Construction, Contro	1 Electric	Drive Tra	ins (EDT)) – Series
	• •	Design, Peak Power Sour				
-		ing. Switched Reluctance N				
Drive Convertor, Design			.101015 (51			stracture,
Unit – 3	Number of	Title of the unit: Electro	onics and	Sensor-le	ss contro	in EV
	lectures = 10		inco unu			
Basic Electronics Device		s, BJTs, MOSFETs, IGBT	s Convert	ors Inver	ters Safet	v – Risks
	• •		-	-	•	-
Drive Cars.	and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, Self Drive Cars					
Unit – 4	Number of	Title of the unit: Hybrid	Vehicles			
	lectures = 10					
Hybrid Electric vehicles		licro, Mild, Full, Plug-in, I	EV Lavo	ut and Ar	chitecture	– Series
		on systems and compone	•			
	• •	c Vehicles System – Analy	-		-	,,

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/

13. Books Recommended

Text Books:

ii) 1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.

iii) Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel
Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
ii) James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Department Electives-VI

1.	1. Name of the Department- Mechanical Engineering							
2.	Course	Sensors &		L		Т		Р
	Name	Actuators						
3.	Course			3		0		0
	Code							
4.	4. Type of Course (use tick mark)			Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5.	Pre-	NIL	6.	Frequency	Even ()	Odd (✔)	Either	Every
	requisite (if			(use tick			Sem ()	Sem ()
	any)			marks)				

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 42Tutorials = 0P

Practical = 0

8. Course Description

One of the key elements in the implementation of mechatronic systems is the integration of computational intelligence with sensing (measurement of environmental conditions) and actuation (affecting the surrounding environment through a controlled response). In this course, students are introduced to advanced concepts in sensing and actuation for mechatronic systems, including both traditional sensors and actuators an introduction to advanced topics in micro electromechanical system (MEMS) sensing, and smart materials.

9. Learning objectives:

- i) To develop understanding of different sensors and their applications.
- ii) To develop understanding of mathematical analysis of sensors
- iii) To develop understanding of different types of actuating devises and their suitability.
- iv) To understand the design of various sensors and actuators.

10. Course Outcomes (COs):

- i) Ability to identify and analyze various sensing system, their classification and characteristics.
- ii) Capability to carryout mathematical analysis of various sensors, like piezoelectric sensors and strain gauge.
- iii) Ability to understand the suitability and applications of different types of actuators.
- iv) Propensity to identify, model and design of various sensing and actuation devices.

11. Unit wise detailed content

Unit-1	Number of	Title of the unit: Introduction
	lectures = 10	

Sensors - Basic requirements of sensors, Classification of sensors, Static and Dynamic characteristics of sensors, Displacement Sensors- Linear and Rotary displacement sensors-Potentiometer, Capacitive and Inductive type displacement sensor- position sensors- Optical encoder.

Unit – 2	Number of lectures = 10	Title of the unit: Types of sensors

Eddy current proximity sensor, Inductive Proximity sensor, Capacitive Proximity sensor, Pneumatic Proximity sensors, Contact and Noncontact type – Strain Gauge – Diaphragm Pressure Sensor- Capsule Pressure sensors-Bellows Pressure Sensor Bourdon tube pressure sensor, Piezoelectric Sensor, Tactile sensor.

Unit – 3	Number of lectures = 11	Title of the unit: Types of sensors cont

Pyroelectric sensors, Ultrasonic sensor, Resistive sensor, Orifice plate, flow nozzle, Electromagnetic flow meter. Thermocouples, Thermistors, Thermo-diodes, Thermotransistors, Bimetallic Strip, Resistance Temperature Detector, Infrared Thermography. Vibrometer and accelerometer- seismic accelerometer. Photoresistors, Photodiodes, Phototransistors, Photo-conductors.

Unit – 4	Number of	Title of the Unit: Actuators
	lectures = 11	

Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, stepper motor.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Clarence W. de Silva, Sensors and Actuators: Control System Instrumentation, CRC Press 2007, ISBN-13: 978-1420044836.

Reference Books

i) Histand, M. B. & Alciatore, D. G., Introduction to Mechatronics & Measurement Systems, McGraw-Hill, 2003.

2.	Course Name	Design of Thermal System	L	Т	Р	
3.	Course Code		3	0	0	
4.	Type of Course (use	e tick mark)	Core ()	PE (✓)	OE ()	
5.	Pre-requisite (if any)	Thermodynami cs, Heat Transfer & Machine Design	6. Frequency (use tick marks)	Even Odd (✓) 0) Either Every Sem () Sem ()	
7.	Total Number of Le	ectures, Tutorials,	Practical (assuming 14	weeks of one seme	ster)	
Lectures = 42			Tutorials = 0	Practical = 00		

8. Brief Syllabus

The design of thermal systems requires an integrated approach that treats thermodynamics, fluid mechanics, and heat transfer as parts of one interconnected area, in which appropriate solutions to real-life design and analysis problems can be obtained only when all these aspects are considered simultaneously (after familiarity with these three topics is achieved in previous dedicated courses.) This approach must be implemented through open-ended problems and design project oriented teaching. Topics related to thermal systems include fluid flow networks, heat exchanger design, design and selection of pumps, fans and compressors, heat recovery systems, psychometrics, air-conditioning systems, electronic cooling systems, fuels and combustion, solar thermal systems, and power plant design. This course is specifically designed to allay the fear of ill-defined problems by teaching the skills to model and translate a physical situation into the relevant equations. The use of equationsolving software facilitates the implementation of this focus by reducing the effort involved in solving equations and affording the opportunity for more discourse on the approach toward modeling of thermal systems. The students will learn the effect of individual component design on overall systems through parametric optimization studies. Topics common to the design of all thermal systems will be taught briefly in an interactive lecture format, but the main emphasis will be on open-ended design problems to be formulated and solved in discussion format. The course will begin with the development of skills for the modeling and parametric investigation of individual thermal system components. As proficiency is gained in these exercises, the students will develop the capability to design overall thermal systems in projects of larger scope. The methodology of translating a problem statement into design tasks and executing them will be illustrated. The understanding of thermal component and system design will be encouraged by requiring the students to view the "solution" to the problem as the beginning rather than the end of a design. Discussion of the effects of changes in design conditions (flow rates, inlet temperatures, etc.) and component geometry (diameter, length, other features) on performance will be emphasized.

9.	Learni	ing objectives:
	i)	To learn overall design requirement and methodology of a thermal system.
	ii)	To learn tools and techniques of analysis of a thermal system.
	iii)	How to do modeling of a thermal system.

iv) To techniques of economic analysis of thermal system and how to do optimization of a thermal system.

10. Course Outcomes (COs):

- i) Students should be able to have knowledge of different aspects of designing of a thermal system.
- ii) Students should be able to identify and examine a design problem associated to a thermal system,
- iii) Students should be able to understand basics of modeling and their associated techniques,
- **iv**) Students should be able to explain economic aspect of designing and able to apply different techniques of optimization applicable to thermal system.

11. Unit wise detailed content

		•	
Unit-1	Number	of	Title of the unit: Fundamentals of Design
	lectures = 10		

Requirement of engineering design, Other similar terms: Analysis, Synthesis, Selection and Optimization. Characteristics of a thermal system, types and analysis.

Formulation of the Design Problem, Conceptual Design, Steps in the Design Process, Computer-Aided Design, Material Selection

Unit – 2	Number of	Title of the unit: Modelling
	lectures = 11	

Modelling Basics: Importance of Modelling in Design, basic features of modelling, Types of Models-Analogue, Mathematical, Physical and Numerical. Mathematical modelling – general procedure, final model and validation.

Modelling Techniques: Physical modelling and dimensional analysis, Curve fitting – exact and best fit. Synthesis of Different Design Steps – Initial design, Design strategies- commonly used design approach and Iterative design procedure.

Unit – 3	Number of	Title of the unit: Economic considerations
	lectures = 10	

Economic Considerations: Calculation of interest- simple, compound, continuous compounding and effective. Worth of money as function of time. Types of payments. Bonds and stocks, Taxes and depreciations. Cost comparison and rate of return. Application to thermal system.

Unit – 4	Number of	Title of the unit: Optimization
	lectures = 11	

Optimization- Introduction: Need of optimization, Basic concepts- Objective function, constraints, mathematical formulation for optimization.

Methods of Optimization: Calculus method, Search method and Geometrical programming Practical aspect of Optimal design – choice of variables, sensitivity analysis, dependence on objective function, multi-objective optimization.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

Sons, 2009. ISBN: 978-1-119-45479-3.

13. Books Recommended:

Text Books

- Jaluria, Yogesh. Design and optimization of thermal systems. CRC press, 2007.Stoecker, W.F. Design of Thermal Systems, McGraw-Hill, New York. ISBN-13: 978-0849337536.
- **ii**) Dieter, G.E., Engineering Design: A Materials and Processing Approach, McGraw-Hill, 2008. ISBN-13: 978-0071263412.

Reference Books

 i) Janna, William S. Design of Fluid Thermal Systems-SI Version. Cengage learning, 2010. ISBN-13: 978-1305076075.
 ii) Rieder, W.G. and Busby, H.R. Introductory Engineering Modelling Emphasizing differential Models and Computer Simulation, Wiley, 1986. ISBN-13: 978-0471895374.
 iii) Collier, Courtland A., and William Burl Ledbetter. Engineering economic and cost analysis. Harpercollins College Division, 1988. ISBN-13: 978-0060413330.
 iv) Fox, R.L. Optimization Methods for Engineering Design, Addison-Wesley, 1971. ISBN-13: 978-0201020786.
 v) Rao, Singiresu S., and S. S. Rao. Engineering optimization: theory and practice. John Wiley &

2.	Course Non- Name Conventional Machining		L	Т		Р		
3.	3. Course Code		3		0	0		
4.			Core ()	PE (✓)	OE ()	Specialization ()		
5.	Pre- requisite (if any)	Manufacturing Process and Technology	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()	
7.	Total Num Lectures =		itorials, Practical (a Tutorials = 0		4 weeks o ical = 0	f one semeste	er)	
pro pre are	cess known a pare intereste used.	as non-conventional ed students for futur	advance manufactur manufacturing. The e careers manufactur undergoing this cours	nonconve ing indust	ntional ma ry where no	nufacturing is	designed to	
pro pre are	cess known a pare intereste used. Learning ok i) To comp tradition	as non-conventional ed students for futur ojectives: Students u pare traditional and r al machining proces	manufacturing. The e careers manufactur undergoing this cours non-traditional machi s.	nonconve ing indust	ntional ma ry where no ected to: ess and reco	nufacturing is on-conventior	designed to nal machines	
pro pre are	 cess known a pare interester used. Learning of traditionation (1998) ii) To compute traditionation (1998) iii) To Learning (1998) 	as non-conventional ed students for futur ojectives: Students u pare traditional and r al machining proces in the numerical cont rstand the role of pro	manufacturing. The e careers manufactur undergoing this cours	nonconve ing indust se are expe ning proce gy in non-o netal remo	ntional ma ry where no ected to: ess and reco conventiona val rate.	nufacturing is on-conventior ognize the nee al Machining	designed to nal machine d for Non- process.	
pro pre are 9.	 cess known a pare interester used. Learning of traditiona ii) To comp traditiona iii) To Learning iii) To under iv) Learning Course Out a processer ii) To recog 	as non-conventional ed students for future ojectives: Students u pare traditional and r al machining process in the numerical cont rstand the role of pro- g about different type comes (COs): On co- rstand the need of N s. gnize the CNC and the	manufacturing. The e careers manufactur undergoing this cours non-traditional machi s. rol and thermal energy pocess parameters in n es of non-convention ourse completion stu on-Traditional Mach	nonconve ing indust se are expe ning proce gy in non-o netal remo al machini dents will ining Proce	ntional ma ry where no ected to: ess and reco conventiona val rate. ing process be able to: esses and a conal machi	nufacturing is on-conventior ognize the nee al Machining and advance able to Classif	designed to nal machine ed for Non- process. machines. y various s.	
pro pre are 9.	 cess known a pare interester used. Learning of traditionation in To computationation in To Learning ii) To Learning iii) To under processer ii) To recog iii) To recog iii) To apply machinir iv) To under electroch 	as non-conventional ed students for future ojectives: Students up are traditional and r al machining process in the numerical cont rstand the role of pro- g about different type comes (COs): On co- rstand the need of N s, mize the CNC and the r the knowledge of p ing processes.	manufacturing. The e careers manufactur undergoing this cours non-traditional machi s. rol and thermal energo ocess parameters in n es of non-convention ourse completion stu on-Traditional Mach	nonconve ing indust se are expe ning proce gy in non-o netal remo al machini dents will ining Proc nontraditio calculate	ntional ma ry where no ected to: ess and reco conventiona val rate. ing process be able to: esses and a be able to: esses and a	nufacturing is on-conventior ognize the nee al Machining and advance able to Classif ning processes nance of non-t	designed to nal machines ed for Non- process. machines. y various s. raditional	

Non-Conventional Machining Methods: Classification of non-traditional machining methods, their comparative study with traditional machines, economic considerations, applications and limitations.

Principle, process parameter and classifications of AJM, determination and evaluation of MRR and applications and limitations.

Unit – 2	Number of	Title of the unit: Numerical control and Thermal based Process
	lectures = 12	

Concepts and types, position and motion control constructional features of NC machines CNC and DNC. Ultrasonic Machining, Principle, applications and process parameters, purpose of slurry selection, analysis of process parameters. Plasma Arc Machining: Principles and applications.

Electron Beam Machining Principle, advantages and limitations.

Unit – 3	Number of	Title of the unit: Electrical energy Based Process
	lectures = 10	

Electric Discharge Machining, Principle and applications, mechanism of metal removal, basic EDM circuits, evaluation of metal removal, calculation of metal removal rate and optimization of MRR, selection of tool material and dielectrics

Unit – 4	Number of	Title of the unit: Electro chemical energy-based process
	lectures = 10	

Principle and classification of ECM, Chemical machining and electro chemical machining, etchants maskant, techniques of applying maskant, process parameters, surface finish and MRR applications principles of ECM Equipment, surface roughness. Determination and evaluation of MRR, Electrochemistry of ECM, selection of electrolytes and analysis of ECM, Electro Chemical Grinding.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

i) El-Hofy, H. A. (2005), "Advanced Machining Processes: Nontraditional and Hybrid Machining Processes" United Kingdom: McGraw-Hill Education, ISBN: 9780071466943, 0071466940.

- i) Pandey, P. C., Shan, H. S. (1980), "Modern Machining Processes", India: McGraw-Hill, ISBN: 9780070965539, 0070965536
- ii) Paulo Davim J. (2013), "Nontraditional Machining Processes: Research Advances", Netherlands: Springer London, ISBN: 9781447151791, 1447151798

iii) Mishra, P. K. (2007), "Nonconventional Machining", India: Narosa Publishing House, ISBN: 9788173191923, 8173191921

2. Co	ourse Name	Mechanism & Manipulator Design	L	Т		Р	
3. Co	ourse Code		3	0		0	
4. Ty	ype of Course (us	se tick mark)	Core ()	PE (✔)	OE 0	EAS ()	BSC ()
	re-requisite (if ny)	Engineering Mechanics	6. Frequen cy (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. To	otal Number of L	ectures, Tutorials, Practical	(assuming 14 w	eeks of on	e semes	ter)	
Lectu	res = 42		Tutorials = 0	Practical	l = 0		
This c		n sically kinematics of Robots c sis of Robot. It consists Actuat		-		-	
iv) 10. Co i) ii) iii)) To understand t ourse Outcomes Understand the Understand the) Understand the	he Kinematics of Robots. he motion planning of the rob (COs): links, pairs and chains. different mechanisms uses in anatomy of manipulators. basic design and dynamics of	machines.				
11. Ui	nit wise detailed	content					
Unit-1	l	Number of lectures = 10	Title of the un	it: Mechar	nism De	sign	
	•	nics, Mechanisms and Mach ematic Diagrams, Kinematic Ir		•			atic Pairs,
Unit –	nit – 2 Number of lectures = 10		Title of the unit: Mechanism Synthesis				
Cheby	shev spacing, Tl	of mechanism; motion, pat hree position synthesis, grap ich and order defects, Analytic	hical approach	for four li	ink mec	hanisms,	
Unit –	- 3	Number of lectures = 11	Title of the un	it: Manipu	ılator K	inematics	
		n and transmission systems, H matics, Rigid body dynamic	e				
Invers approa							

Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

- i) A. Ghosh (2009), Theory of Mechanisms and Machines, 3rd Edition, East-West Press Pvt. Ltd., New Delhi, ISBN: 978-8-185-93893-6.
- ii) Robotics and Control by R K Mittal and I J Nagrath, Mcgraw Hill, 2003, ISBN: 9780070482937

- i) Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, (2010), Robotic Engineering an Integrated Approach, 1st Edition, Prentice-hall of India. ISBN: 978-8-120-30842-8.
- S. R. Deb and Sankha Deb (2009), Robotics Technology and Flexible Automation, 2nd Edition, Tata McGraw-Hill Edu-cation. ISBN: 978-0-070-07791-1.
- iii) Robert Joseph Schilling (2007), Fundamentals of Robotics: Analysis and Control, Prentice Hall India. ISBN: 978-8-120-31047-6.
- iv) John J. Craig (2008), Introduction to Robotics: Mechanics and Control, 3rd Edition, Pearson Education. ISBN: 978-8-131-71836-0.

1. Name of the	e Department- Mech	nanical Engineering					
2. Course	Engine Design			Т		Р	
Name	0 0						
3. Course		3		0		0	
Code							
	ourse (use tick	Core ()	PE (✓)	OE ()	EAS ()	BSC ()	
mark)		0					
5. Pre-	NIL	6. Frequency	Even	Odd (✔)	Either	Every Sem	
requisite		(use tick	0	000()	Sem ()	0	
(if any)		marks)	\checkmark			\checkmark	
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures =		Tutorials = 0	Practio		,		
8. Course De	scription						
	-	IC Engine Systems	and Systems	Modeling, a	and is orient	ed to graduate	
	1	ng, testing, analyzing	2	0		U	
9. Learning o		<u>6,</u> <u>6,</u> <u>7</u> <u>6</u>	,	0 . 0		, and the second s	
i) To make students familiar with the design and operating characteristics of modern internal combustion							
engines.							
e		es to the engineering p	problems and	performance	analysis of i	nternal	
	tion engines.				, analy 515 01 .		
	e	s, combustion, heat tra	ansfer, friction	n and other f	actors affecti	ng engine	
	efficiency and emission						
•	•	environmental and fue	el economy ch	allenges fac	ing the interr	nal	
	tion engine.						
		curriculum of the Dep	artment is des	igned to sat	isfy the dive	se needs of	
students.		cannearann or the Dep		igned to sut	isiy the arres		
	tiate among different	internal combustion	engine design	S.			
	-	easons for differences			eristics of d	fferent engine	
-	d designs		uniong open			and and angline	
51	U	ast experimental result	ts with theor	etical trends	and to attri	bute observed	
	-	rement error or mode			,		
•		ize future engine des	•		constraints (fuel economy.	
-	ance, emissions)	6	8		(,	
	letailed content						
Unit-1	Number of	Title of the unit: I	ntroduction				
	lectures = 10						
Design procedu		sis, design considerat	ions, material	selection &	actual desig	n of	
• •	•	ylinder head design, p			e e		
		sign, flywheel design,	-				
Unit – 2	Number of	Title of the unit:				ng & Design	
-	lectures = 10	Parameters			intouchi		
Governing equa		harts of combustion	chemistry C	nemical read	ction rates	Approaches of	
	-	ation methods. Gas ex	-				
-		rves. Engine balancir					
-		Engine layout, major		-			
		design principles of ex	-		ieur speeu, a	Sign of engine	
mounting, desig	n or cooning system, (acorgin principles of e.		system			

Unit – 3	Number of	Title of the unit: Thermodynamic Combustion Models of Engines
	lectures = 11	

Single zone models, premixed and diffusive combustion models, combustion heat release using Wiebe function, wall heat transfer correlations, ignition delay, internal energy estimations, two-zone model, applications of heat release analysis. for drawing die.

Unit – 4	Number of	Title of the Unit: Mathematical Models of SI Engines
	lectures = 11	

Simulation of Otto cycle at full throttle, part throttle and supercharged conditions, progressive combustion, Autoignition Modeling, single zone models, multi-zone models and mass burning rate estimation, SI engine with stratified charge. Friction in pumping, in piston assembly, bearings and valve train etc. Friction estimation for warm and the warm-up engines.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

i) William Harry Crouse- Engine Design, Tata McGraw Publication, Delhi, 2017, ISBN: 9780070634350

Reference Books:

i) Internal Combustion Engine Modeling, J.I. Ramos, Hemisphere Publishing Corporation, 1989.

 Modeling Engine Spray and Combustion Processes, G. Stiesch, Springer Verlag, 2003, ISBN: 9783662087909

iii) Giles J. G.- Engine Design, Lliffe Book Ltd., London, Latest Edition, ASIN: B0000COABL

iv) William Harry Crouse- Engine Design, Tata McGraw Publication, Delhi, 2017, ISBN: 9780070634350

 v) Internal Combustion Engine Fundamentals, John B Heywood, McGraw-Hill, 1988, ISBN: 007028637X

1.	Name of the Depart	tment- Mechanical E	Ingineering				
2.	Course Name	Battery	L]	Г]	P
1		Management					
1		System					
3.	Course Code		3	()	(0
4.	Type of Course (use	e tick mark)	Core ()	PE (✔)	PE (✓) 0		
5.	Pre-requisite (if	Introduction to	6. Frequency (use	Even	Odd ()	Either	Every
1	any)	Electric and	tick marks)	(✔)		Sem ()	Sem ()
1	•	Hybrid Vehicles					
7.	7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Le	ctures = 42		Tutorials = 0	Practica	l = 0		
8.	Course Description						
Th	is course introduces th	e fundamental concep	ots, principles, analysis and	design of	hybrid an	d electric	vehicles.
Th	e material for this cou	urse will be prepared i	in such a manner that it wi	ll be usefi	ıl for post	-graduate	students,
tea	chers, practitioners an	d final year undergrad	luate students.				
9.	Learning objectives	The objective of thi	s course is to				
	i) Iden	tify the requirements	of Battery Management Sy	vstem			
1	ii) Intro	duce learner to batter	ies, its parameters and mod	delling.			
	iii) Introduce learner to batteries charging requirements						
1	iv) The	course will help learn	er to develop battery mana	gement al	gorithms	for batteri	es.
10	. Course Outcomes (COs): On successful	completion of this course,	the studen	t will be a	ble to	
	i) Inter	pret the role of batter	y management system				
	ii) Inter	pret the concept asso	ciated with battery charging	g / dischai	ging proc	ess	
	iii) Calc	ulate the various para	meters of battery and batte	ry pack			
1	iv) Desi	ign the model of batte	ry pack				
11	. Unit wise detailed c	ontent					
Un	it-1	Number of	Title of the unit: Introdu	uction			
1		lectures = 10					
Int	roduction to Battery N	Management System,	Cells & Batteries, Nomina	l voltage	and capac	ity, C rate	e, Energy
and	l power, Cells conne	ected in series, Cells	connected in parallel, E	lectrochei	nical and	lithium-i	on cells,
Re	chargeable cell, Charg	ging and Discharging	Process, Overcharge and U	ndercharg	e, Modes	of Chargi	ng.
Un	it – 2	Number of	Title of the unit: Batter	y Manag	ement Sys	stem	
L		lectures = 12	Requirement				
Int	roduction and BMS fu	inctionality, Battery p	ack topology, BMS Functi	onality, V	oltage Sei	nsing, Ten	nperature
Ser	nsing, Current Sensir	ng, BMS Functionali	ty, High-voltage contacto	r control,	Isolation	sensing,	Thermal
coi	ntrol, Protection, Com	munication Interface,	, Range estimation, State-o	of charge	estimatior	n, Cell tota	al energy
and	l cell total power.						
Un	it – 3	Number of	Title of the unit: Battery	State of	Charge a	nd State o	f Health
		lectures = 10	Estimation, Cell Balanc	ing			
Ba	ttery state of charge es	timation (SOC), volta	ge-based methods to estima	ate SO <mark>C, N</mark>	Aodel-bas	ed state es	timation,
Ba	ttery Health Estimation	on, Lithium-ion aging	: Negative electrode, Lithi	um ion ag	ging: Posi	tive electr	ode, Cell
Ba	lancing, Causes of im		-				
Du							
	it – 4	Number of	Title of the unit: Design	of batter	y BMS		
	it – 4	Number of lectures = 10	Title of the unit: Design	of batter	y BMS		
Un De		lectures = 10 ery BMS, Effect of di	Title of the unit: Design stance, load, and force on t			S, energy b	balancing

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Ibrahim Dinçer, Halil S. Hamut and Nader Javani, "Thermal Management of Electric Vehicle Battery Systems", JohnWiley& Sons Ltd., 2016

Reference Books

- i) James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, 2003
- **ii**) Chris Mi, Abul Masrur& David Wenzhong Gao, "Hybrid electric Vehicle- Principles & Applications with Practical Properties", Wiley, 2011.

1. Name of the De	partment- Mechanica	l Engineering					
2. Course Name	Fluid Mechanics and Machines Lab	L			Т	-	Р
3. Course Code		0			0		4
4. Type of Course	(use tick mark)	Core (✓)	PE	0		OE ()	
5. Pre-requisite	Engg. Maths & Mechanics	6. Frequency (use tick marks)	Eve	n ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Number of	of Lectures, Tutorials	, Practical (assuming 1	14 wee	ks of o	one semester)	
Lectures = 00		Tutorials = 00		Prac	tical = 56		
8. Course Descrip	tion:						
or liquids) either in r solid surfaces or inte dynamics of fluid f	notion or at rest and th rfaces with other fluids flow. After that stude	of continuum mechanic e subsequent effects of . This course deals fluic nt learn the fundamen .nd their applications in	fluids ls and tals of	upon l their p f flow	ooundaries, w roperties, and through pip	hich may the kinem	be either natics and

9. Learning Objectives:

- i) Understand fluid behavior for engineering design and control of fluid systems.
- ii) Develop competence with mass, energy and momentum balances.
- iii) Study the development of boundary layers and model similitude.
- iv) Study about various turbines and pumps designed on above concepts

10. Course Outcomes (Cos):

- i) Understand the fundamental models for analyzing a fluid flow and fluid at rest both.
- ii) Find the dependent and independent parameters for a fluid flow.
- iii) Explain various methods available for boundary layer separation and analyze the model and prototype.
- iv) Understand the working principles of turbines and pumps

11. Lab component Sr. No. Title CO covered						
Sr. 100.	Title	CO covered				
1	Conducting experiments to verify Bernoulli's theorem.	i)				
2	Determination of the Coefficient of discharge and coefficient of velocity	i), iii)				
	for the given Orifice meter.					
3	Determination of the Coefficient of discharge of given Venturi-meter.	i), iii)				
4	Determination of the Coefficient of discharge of given of Notch (V and	iii)				
	Rectangular types)					
5	Comparative study of head loss in pipes connected series and parallel.	ii)				
6	Study of fluid flow types using Reynolds apparatus.	ii)				
8	To determine the coefficient of impact for vanes.	iv)				
10	To determine the meta-centric height of a floating body.	i)				
11	To study the constructional details of a Pelton turbine and draw its fluid flow	iv)				
	circuit.					

12	To draw the following performance characteristics of Pelton turbine-constant	iv)
	head, constant speed and constant efficiency curves.	
13	To study the constructional details of a Francis turbine and draw its fluid flow	iv)
	circuit.	
14	To draw the constant head, constant speed and constant efficiency performance	iv)
	characteristics of Francis turbine.	
15	To study the construction details of a Kaplan turbine and draw its fluid flow	iv)
	circuit.	
16	To draw the constant head, speed and efficiency curves for a Kaplan turbine.	iv)
17	To study the constructional details of a Centrifugal Pump and Reciprocating	iv)
	Pump.	

1. Name of the Department- Mechanical Engineering							
2. Course Name	Kinematics of	L	Т		Р		
	Machines Lab						
3. Course Code		0	0		2		
4. Type of Course (us	se tick mark)	Core (✓)	PE ()		OE ()		
5. Pre-requisite (if	+2 Level Physics	6. Frequency (use	Even ()	Odd	Either	Every	
any)		tick marks)		(✔)	Sem ()	Sem ()	
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures = 0		Tutorials = 0	Practica	l = 28			

8. Brief Syllabus

The analysis of a machine requires the determination of the movement or kinematics of its component parts, known as kinematic analysis. The assumption that the system is an assembly of rigid components allows rotational and translational movement to be modelled mathematically. This allows the position, velocity and acceleration of all points in a component to determine from these properties for a reference point and the angular position, angular velocity and angular acceleration of the component. Students learn Basics of Mechanisms, kinematic analysis of simple mechanisms, synthesis of simple mechanisms, kinematics of CAMS and kinematics of gears and gear trains.

9. Learning objectives:

- i) To familiarize students with basic types of mechanisms, joints and degrees of freedom to perform position, velocity and acceleration analysis using graphical and analytical methods.
- ii) To provide students an understanding of different types of mechanisms.
- iii) To teach the basics of synthesis of simple mechanisms.
- iv) To teach students the kinematic analysis of cam-follower motion and gears.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Demonstrate an understanding of the concepts of various mechanisms and pairs.
- ii) Conduct velocity and acceleration analysis of simple mechanisms.
- iii) Synthesize simple mechanisms for function, path generation and body guidance.
- iv) Design a layout of cam for specified motion and demonstrate an understanding of principles of operation of gears. Also, demonstrate an understanding of various drives.

11. Lab Component

Sr. No.	Title	COs covered
1	To study various types of Kinematic links, pairs, chains and Mechanisms.	i)
2	To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.	i)
3	To plot slider displacement, velocity and acceleration against crank rotation for a single slider crank mechanism.	ii)
4	To find coefficient of friction between belt and pulley.	iv)
5	To study various types of cam and follower arrangements.	iv)

6	To plot follower displacement vs cam rotation for various Cam Follower systems.	iv)
7	To generate spur gear involute a tooth profile using a simulated gear shaping process.	iv)
8	To study various types of gears – Helical, cross helical worm, bevel gear.	iv)
9	To study various types of gear trains – simple, compound, reverted, epicyclic and differential	iv)
10	To plot slider displacement, velocity and acceleration against crank rotation for different mechanisms using the software.	i), ii)
11	To study nomenclature of cam and plotting the cam profile.	iv)

Department Electives-V Lab

2.	Course Name	Robotics Engineering and Applications Lab	L		Τ		Р		
3.	Course Code		0 0		0 0		0		2
4.	Type of Course	(use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()		
5.	Pre-requisite	NA	6. Frequency (use tick marks)	Even ()	Odd (🗸)	Either Sem ()	Every Sem ()		
		of Lectures, Tutorials	, Practical (assuming 1			•)			
Leo	ctures = 0		Tutorials = 0	Prac	ctical = 28				
ob	ot control. Progra Learning Object	amming of Robots and	ction Cartesian space scl Vision System.	heme, adapt	ive control, a	nd Servo s	ystem fo		
10.	 manipulator scenarios. Make the stu Enable the stu Make the stu Make the stu to various ro Course Outcom i) Understand ii) Differentiate iii) Analyze for	kinematics & dynamic udents acquainted with tudents to acquire prac- udents understand the in boots and their operation nes (COs): At the end of the basic components of types of robots and ro ces in links and joints of	of this course, the learne of robots. bot grippers. of a robot.	ction of robo of Robotics ield of Robo various field or will be:	otic system fo	or various	industria s.		
	 manipulator scenarios. Make the stu Enable the stu Make the stu Make the stu to various ro Course Outcom i) Understand ii) Differentiate iii) Analyze for	kinematics & dynamic udents acquainted with tudents to acquire prac- udents understand the in obots and their operation nes (COs): At the end of the basic components of the basic components of the basic somponents of the basic components of a robot to perform task	cs, application and select the theoretical aspects of tical experience in the fir mportance of robots in v anal details. To f this course, the learned of robots. bot grippers.	ction of robo of Robotics ield of Robo various field or will be:	otic system fo	or various	industria s.		
	ii) Make the stu iii) Enable the stu iv) Make the stu to various ro ii) Understand ii) Differentiate iii) Analyze for iv) Programme Lab Componen	kinematics & dynamic udents acquainted with tudents to acquire prac- udents understand the in obots and their operation nes (COs): At the end of the basic components of the basic components of the basic somponents of the basic components of a robot to perform task	cs, application and select the theoretical aspects of tical experience in the fir mportance of robots in v nal details. of this course, the learned of robots. obot grippers. of a robot.	ction of robo of Robotics ield of Robo various field or will be:	otic system fo	or various	industria s. bose the		
11. 5r. No.	 manipulator scenarios. ii) Make the structure iii) Enable the structure iv) Make the structure ii) Understand iii) Differentiate iii) Analyze ford iv) Programme Lab Componen 	kinematics & dynamic udents acquainted with tudents to acquire prac- udents understand the in obots and their operation nes (COs): At the end of the basic components of the basic components of the basic somponents of the basic components of a robot to perform task	cs, application and select the theoretical aspects of tical experience in the fir mportance of robots in v anal details. of this course, the learned of robots. obot grippers. of a robot. ts in industrial application	ction of robo of Robotics ield of Robo various field or will be:	otic system fo	or various case studie ng and exp	industria s. bose the		
II. Sr. No.	ii) Make the stu iii) Enable the stu iv) Make the stu to various ro Course Outcom i) Understand ii) Differentiate iii) Analyze for iv) Programme Lab Componen I Study of ro	kinematics & dynamic udents acquainted with tudents to acquire prac- udents understand the in obots and their operation nes (COs): At the end of the basic components of the basic components of e types of robots and ro ces in links and joints of a robot to perform task at	cs, application and select the theoretical aspects of tical experience in the fir mportance of robots in v anal details. of this course, the learned of robots. obot grippers. of a robot. ts in industrial application	ction of robo of Robotics ield of Robo various field or will be:	otic system fo	or various case studie ng and exp COs cov i), ii	industria s. bose the ered		
11. Sr. No.	ii) Make the stu iii) Enable the stu to various ro Course Outcom i) Understand ii) Differentiate iii) Analyze ford iv) Programme Lab Componen I Study of ro 2 Study the r	kinematics & dynamic udents acquainted with tudents to acquire prac- udents understand the in obots and their operation nes (COs): At the end of the basic components of e types of robots and ro ces in links and joints of a robot to perform task at	cs, application and select the theoretical aspects of tical experience in the fir mportance of robots in v anal details. of this course, the learned of robots. obot grippers. of a robot. ts in industrial application	ction of robo of Robotics ield of Robo various field or will be:	otic system fo	or various case studie ng and exp COs cov i), ii	industria s. bose the ered), iv)		
11. Sr. No.	ii) Make the str iii) Enable the str iv) Make the str to various ro iv) Understand ii) Differentiate iii) Analyze ford iv) Programme Lab Componen I Study of ro 2 Study the r	kinematics & dynamic udents acquainted with tudents to acquire prac- udents understand the in obots and their operation nes (COs): At the end of the basic components of e types of robots and ro ces in links and joints of a robot to perform task at	cs, application and select the theoretical aspects of tical experience in the fir mportance of robots in v nal details. of this course, the learned of robots. obot grippers. of a robot. ts in industrial application	ction of robo of Robotics ield of Robo various field or will be:	otic system fo	COs cov i), ii	industria s. bose the ered), iv)		

6	Robot programming and simulation for machining (cutting, welding)	i), iv)
7	Robot programming and simulation for writing practice	i), iv)
8	Robot programming and simulation for any industrial process (Packaging, Assembly).	i), iv)

1.	Name of	the l	Department- M	echa	nical Enginee	ring				
2.	Course Name		ar and clear Power gineering Lab		L		T		Р	
3.	Course Code				0		0		2	
4.	Type of mark)	Cou	urse (use tick		Core ()		PE	2(✔)	OE ()	
5.	Pre- requisite any)	e (if	Engineering Thermodyn amics	6.	Frequency tick marks)	(use	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Nu	ımbe	er of Lectures, '	Tuto	rials, Practica	l (assu	ming 14	weeks o	f one seme	ster)

Tutorials = 0

Practical = 28

8. Brief Syllabus

The combination of continual nuclear power with solar energy stored in the salts allows the reactor to generate super-heated steam to run electricity even at night. Studies predict solarnuclear hybrid power plants to be far more efficient in power generation compared to nuclear or solar power plants alone. Solar energy systems include collectors to convert solar radiation to heat in a fluid, energy storage units which are designed to accumulate energy when it is available and deliver it when needed, means to deliver the energy from the storage to a load, and necessary pumps, controls, etc. On the other hand Nuclear Power Engineering concentrates on the principles, techniques and processes involved in generation of power from nuclear fuels. This involves studying and exploring various aspects of science ranging from processing of nuclear fuel to merits and demerits of various nuclear reactors and from reprocessing of nuclear waste to their safely disposal. Upon completion of this course students will be able to have better understanding of nuclear processes involved in nuclear power generation, know working and pros & cons of various reactors and also have understanding of nuclear power generation and safety rules implemented during power generation from nuclear fuels and nuclear waste disposal.

- 9. Learning Objectives: The student will be exposed to the basic physics of solar energy system
 - i) The student will be exposed to the basic physics of solar energy system.
 - ii) The student will be exposed to the basic physics of applications of solar based energy equipment.

- iii) The student will be exposed to the basic physics of nuclear reactions and operation of nuclear reactors.
- iv) To learn various types of Nuclear power generation methods, safety and its impact on environment.

10. Course Outcomes (COs): On completion of this course, the student will be able to:

- i) Know the fundamentals of solar energy systems operations.
- ii) Aware to the concept of solar thermal and photovoltaic operating systems.
- iii) Know the nuclear fission and fusion processes.
- iv) Understand the working of nuclear reactors and understand power generation and safety aspects.

11. Lab Components

Sr. No.	Title	COs Covered
1	Understand the working of nuclear reactors and understand power generation and safety aspects.	i), ii)
2	Determination of parameters of Flat Plate Collector – Thermo siphon Mode	ii), iii)
3	Determination of parameters of Flat Plate Collector for different mass flow rate	ii),
4	Determination of parameters of Flat Plate Collector for different radiation	ii), i)
5	To illustrate the determination of trace impurities by neutron activation.	ii), iv)
6	To determine the critical mass of an unknown configuration of fuel and reflector elements by performing a critical experiment on the Ford Nuclear Reactor.	ii), iv)
7	To study the operation, calibration, and uses of scintillation counters in gamma ray spectroscopy	iv)
8	To impart an understanding and an appreciation of the problems of reactor startup, operation at power level, and shutdown.	iv)

	partment- Mechanical	2 2					_
2. Course Name	Rapid	L		Т		P	
	Manufacturing						
	Technologies Lab						
3. Course Code		0)	0			2
4. Type of Course	(use tick mark)	Core ()	EAS ()	PE (✔)		OE ()	BSC ()
5. Pre-requisite		6. Frequency	y (use tick	Even ()	Odd	Either	Every
(if any)		marks)			(🗸)	Sem ()	Sem ()
7. Total Number of	of Lectures, Tutorials, 1	Practical (assun	ning 14 weeks	of one ser	l nester)		
Lectures = 0		Tutorials = 0		Practica	1 10		
8 Priof Syllabus				Fractica	1 = 28		
The syllabus includ technology used in l relevant additive and	es importance of rapid Rapid manufacturing. D I rapid manufacturing pr ferent industrial sectors.	l additive manu Data formats to a rocess. It also in	acquire knowl	advance m edge, tech	nanufac niques	and skills	to selec
technology used in l relevant additive and manufacturing in diff	Rapid manufacturing. D I rapid manufacturing pr	l additive manu Data formats to a rocess. It also inc	acquire knowl cludes case stu	advance m edge, tech	nanufac niques	and skills	to select
The syllabus includ technology used in 1 relevant additive and manufacturing in diff 9. Learning objectiv	Rapid manufacturing. D I rapid manufacturing pr ferent industrial sectors.	I additive manu Data formats to a rocess. It also in g this course are	acquire knowl cludes case stu expected to:	advance m edge, tech	nanufac niques	and skills	to select
The syllabus includ technology used in 1 relevant additive and manufacturing in diff 9. Learning objectiv i) To know the	Rapid manufacturing. D I rapid manufacturing pr ferent industrial sectors. ves: Students undergoing	additive manu Data formats to a rocess. It also in g this course are nufacturing Proc	acquire knowl cludes case stu expected to:	advance m edge, tech adies to exj	nanufac niques	and skills	to selec
The syllabus includ technology used in 1 relevant additive and manufacturing in diff 9. Learning objectiv i) To know the ii) To understar	Rapid manufacturing. D I rapid manufacturing pr ferent industrial sectors. ves: Students undergoing Principles of Rapid Ma	additive manu Data formats to a rocess. It also in g this course are nufacturing Proc of Rapid Manuf	acquire knowl cludes case stu expected to: cesses. facturing Tech	advance m edge, tech idies to exp	nanufac niques plore th	and skills e potentia	to selec
The syllabus includ technology used in 1 relevant additive and manufacturing in diff 9. Learning objectiv i) To know the ii) To understar iii) To familiariz	Rapid manufacturing. D I rapid manufacturing pr ferent industrial sectors. ves: Students undergoing Principles of Rapid Ma nd with various methods	additive manu Data formats to a rocess. It also in g this course are nufacturing Proc of Rapid Manuf	acquire knowl cludes case stu expected to: cesses. facturing Tech cerials used in	advance m edge, tech idies to exp nologies. Additive M	nanufac niques plore th	and skills e potentia	to selec

- i) To Describe the applications of Rapid manufacturing Technologies.
- ii) To select suitable method for Rapid Manufacturing.
- iii) To select suitable material for Rapid Manufacturing.
- iv) To apply the reverse engineering using Additive Manufacturing Technology.

11. Lab Co	mponents	
Sr. No.	Title	CO covered
1	To perform the experiment with methods involved in Rapid Manufacturing Processes	i), ii)
2	To perform the experiment with methods involved in Customization and Mass Customization manufacturing.	i), ii)
3	To perform the experiment with methods involved in Process Chain for Additive manufacturing.	i), ii)
4	To perform the experiment with methods involved in hatching pattern	i), ii)

5	To perform the experiment with methods involved in Diagnosis of STL file	i), ii)
	Error.	
6	To perform the experiment with methods involved in Part orientation,	i), ii)
	Generation/Design of Support in manufacturing	
7	To perform the experiment with methods involved in material jetting based	i), ii), iii)
	manufacturing	
8	To perform the experiment with methods involved in powder bed fusion-based	i), ii), iii)
	manufacturing	
9	To perform the experiment with methods involved in Vat photo polymerization	i), ii), iii)
10	To perform the experiment with methods involved in case study of rapid	i), ii), iii)
	manufacturing	
11	To perform the experiment with methods involved in rapid manufacturing in	iii), iv)
	subtractive case	
12	To perform the experiment with methods involved rapid manufacturing in	iii), iv)
	additives case	

1. 2		-	rtment- Mechanics		Т	1	1	D
2.	Cour	e Name Design for		L			J	Р
			Manufacture &					
_	0	C 1	Assembly Lab	0	0			
3.		se Code		0	0			2
4.	Туре	of Course (u	ise tick mark)	Core ()	PE	OE ()	EAS	BSC
_				·	(✓)		0	0
5.		requisite (if	Design for	6. Frequency (use	Even	Odd	Either	Every
	any)		Mechanical	tick marks)	0	(✔)	Sem ()	Sem (
			Elements					
			Lectures, Tutorials	s, Practical (assuming 1			mester)	
Le	ectures			Tutorials = 0	Practica	l = 28		
8.	Cour	se Descriptio)n					
Th	e Desi	gn for Manuf	facturing and asseml	bly is challenging subje	ct that inclu	udes des	ign princ	iples for
		-	-	s on Design. To learn			• •	-
		•	-	The aim of present cour			-	-
			-	eral design principles v				
		uring as well						F
		ning objectiv						
		6 1		g the manufacturability of	of compone	ents.		
		•	-	that influence changes i	-			
		-	-	sting, forging and welding	-	-		
			cle assessment of the					
		se Outcomes						
10			· · · ·	and external characteris	stic of mate	erial affe	cting des	ion
				for manufacturability.		indi diffe		1511.
		-	• • •	ess based on different	aspects of	f differe	nt manuf	acturin
			machining, drilling e		dispection of	unicie	int manuf	actum
	-		0	us phases in the life of a	product			
11				is phases in the fife of a	product.			
		Component					00	
Sr	. No.	Title					COs co	
	1		• 1	ors Influencing Design				ii)
	2	-		Material, Manufacture fo		_		ii)
	3			Material, Manufacture f	or forging	process		ii)
	4		d design features to				i),	ii)
	5	To study an	d design factures to	facilitate milling cutters	2		ii) ii	i), iv)
	0	re study un	d design features to				<u> </u>	1), 1)
	6	-	d design for machin	-	, 			i), iv)

11. Lab Component						
Sr. No.	Title	COs covered				
1	To study different types of Factors Influencing Design	i), ii)				
2	To study the working principle, Material, Manufacture for welding process	i), ii)				
3	To study the working principle, Material, Manufacture for forging process	i), ii)				
4	To study and design features to facilitate drills	i), ii)				
5	To study and design features to facilitate milling cutters	ii), iii), iv)				
6	To study and design for machinability	ii), iii), iv)				
7	To study the Computer Applications for DFMA	ii), iii), iv)				
8	To study the Identification of uneconomical design	ii), iii), iv)				
9	To study the redesign of castings based on parting line considerations	ii), iii), iv)				
10	To study the Global issues, Regional and local issues, Basic DFE	iii), iv)				
	methods					

11	To study and Design for recyclability	iii), iv)
12	To study and Design for energy efficiency, Design to regulations and	iii), iv)
	standards.	

2.	Course Name	Advanced Automotive Electronics Lab	L	ŗ	Г		Р
3.	Course Code		0		0		2
4.	Type of C	course (use tick mark)	Core ()	PE (✓)	OE 0	EAS ()	BSC ()
5.	Pre- requisite (if any)	Fluid Mechanics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Nur	hber of Lectures, Tutorials	, Practical (assuming 2	14 weeks	s of one	semester)	I
Le	ctures = 0		Tutorials = 0	Practic	cal = 28		
	:) To						
	system ii) To un differe iii) To un	derstand the concepts of Aut ns & subsystems overview. Iderstand sensors and sensor ent signal conditioning techn iderstand, design and mode	or monitoring mechan iques, interfacing techn	isms ali iques and	gned to l actuato	automoti or mechani	ve system sms.
	system ii) To un differe iii) To un develo iv) To un Softwa	ns & subsystems overview. Iderstand sensors and sensor ent signal conditioning techn iderstand, design and mode opment technique. derstand role of Microcontro are.	or monitoring mechan iques, interfacing techn el various automotive ollers in ECU design an	isms ali iques and control nd choice	gned to l actuato systems e of appr	automoti or mechani s using N	ve systems sms. Iodel base
	 system iii) To um differe iii) To um develo iv) To um Softwa i) Develo i) Interfa iii) Obtain protoc	hs & subsystems overview. Iderstand sensors and sensor ent signal conditioning technic iderstand, design and mode opment technique. Iderstand role of Microcontro are. utcomes (COs): On course of op, simulate and integrate co are automotive sensors and a in an overview of automoti ols and safety systems emplo- tibe various communication rking.	or monitoring mechan iques, interfacing techn el various automotive ollers in ECU design an completion students wil ntrol algorithms for EC ctuators with microcom ve components, subsy oyed in today's automo	isms ali iques and control nd choice Us with trollers. stems, d tive indu	gned to l actuato systems e of appr to: hardwar lesign cj stry.	automoti or mechani s using M ropriate Ha e ycles, con	ve system sms. Iodel base ardware an
11.	 system iii) To un differe iii) To un develo iv) To un Softwa iv Develo ii) Interfa iii) Obtain protoc iv) Descri iv) Descri	hs & subsystems overview. Iderstand sensors and sensor ent signal conditioning technic iderstand, design and mode opment technique. Iderstand role of Microcontro are. utcomes (COs): On course of op, simulate and integrate co are automotive sensors and a in an overview of automoti ols and safety systems emplo- tibe various communication rking.	or monitoring mechan iques, interfacing techn el various automotive ollers in ECU design an completion students wil ntrol algorithms for EC ctuators with microcom ve components, subsy oyed in today's automo	isms ali iques and control nd choice Us with trollers. stems, d tive indu	gned to l actuato systems e of appr to: hardwar lesign cj stry.	automotion or mechani s using N ropriate Ha e ycles, con cols used	ve system sms. Iodel base ardware an
11.	system ii) To un differe iii) To un develo iv) To un Softwa Softwa iv) Develo i) Develo ii) Interfa iii) Obtain protoc iv) Descri netwo Lab Com	hs & subsystems overview. Iderstand sensors and sensor ent signal conditioning technic iderstand, design and mode opment technique. Iderstand role of Microcontro are. utcomes (COs): On course of op, simulate and integrate co are automotive sensors and a in an overview of automoti ols and safety systems emplo- tibe various communication rking.	or monitoring mechan iques, interfacing techn el various automotive ollers in ECU design an completion students wil ntrol algorithms for EC ctuators with microcon ve components, subsy byed in today's automo systems, wired and Title	isms ali iques and control nd choice Us with trollers. stems, d tive indu wireles	gned to l actuato systems e of appr to: hardwar lesign cj stry.	automotion or mechani s using N ropriate Ha e ycles, con cols used	ve systems sms. fodel base ardware an nmunicatio in vehicl
11.	systen ii) To un differe iii) To un develo iv) To un Softwa Course O i) Develo ii) Interfa iii) Obtain protoc iv) Descri netwo Lab Comp Sr. No.	hs & subsystems overview. Iderstand sensors and sensor ent signal conditioning techn iderstand, design and mode opment technique. derstand role of Microcontro are. utcomes (COs): On course of op, simulate and integrate co are automotive sensors and a in an overview of automoti ols and safety systems emplo- ible various communication rking. ponent	or monitoring mechan iques, interfacing techn el various automotive ollers in ECU design an completion students wil ntrol algorithms for EC ctuators with microcon ve components, subsy byed in today's automo systems, wired and Title	isms ali iques and control nd choice Us with trollers. stems, d tive indu wireles	gned to l actuato systems e of appr to: hardwar lesign cj stry.	automotion or mechani s using N ropriate Ha e ycles, con cols used	ve system sms. fodel base ardware an nmunicatio in vehicl overed
11.	system ii) To un differe iii) To un develo iv) To un Softwa Course O i) Develo ii) Interfa iii) Obtair protoc iv) Descri netwo Lab Comp Sr. No.	hs & subsystems overview. Iderstand sensors and sensor and signal conditioning technic iderstand, design and mode opment technique. derstand role of Microcontro are. utcomes (COs): On course of op, simulate and integrate co- tice automotive sensors and a in an overview of automoti- ols and safety systems emplo- tibe various communication rking. ponent Study of different types of	or monitoring mechan iques, interfacing techn el various automotive ollers in ECU design an completion students wil ntrol algorithms for EC ctuators with microcom ve components, subsy byed in today's automo a systems, wired and Title sensors used in automo module.	isms ali iques and control nd choice Us with trollers. stems, d tive indu wireles	gned to l actuato systems e of appr to: hardware lesign cy stry. s protoc	automotion or mechani s using M ropriate Ha e ycles, con cols used	ve systems sms. fodel base ardware an nmunicatio in vehicl overed i), ii)

5	Study of antilock braking system.	i), iii), iv)
6	6 Study of battery and their types which are used in automobile.	
7	Study of different types of warning system used in automobile.	i), ii), iii)
8	Study about car dashboard amenities.	i), iii), iv)
9	Study about comfort & safety in a car.	i), iv)
10	Study of various technology used in a car dashboard.	i), iv)

1.	Name of the	Department- Mecha	nical	l Engineering				
2.	Course	Mechatronics		L	Т		Р	
	Name	Systems and Its						
		Applications Lab						
3.	Course			0		0		2
	Code							
4.	Type of Co	urse (use tick		Core ()	PE (✔)	OE ()	EAS ()	BSC ()
	mark)							
5.	Pre-	Applied Physics	6.	Frequency	Even ()	Odd (✔)	Either Sem	Every
	requisite			(use tick			0	Sem ()
	(if any)			marks)				
7.	Total Num	ber of Lectures, Tuto	rials,	, Practical (ass	uming 14 w	eeks of one s	semester)	
	Lectures = 0			orials = 0	Practical = 28			
8.	Course Des	cription	1		1			
Mee	chatronics is	a design process th	hat ii	ncludes a com	bination of	mechanical	engineering,	electrical

Mechatronics is a design process that includes a combination of mechanical engineering, electrical engineering, control engineering and computer engineering. Mechatronics is a multidisciplinary field of engineering, that is to say, it rejects splitting engineering into separate disciplines. Originally, mechatronics just included the combination of mechanics and electronics, hence the word is a combination of mechanics and electronics; however, as technical systems have become more and more complex the word has been "updated" during recent years to include more technical areas.

9. Learning objectives:

- i) To introduce integrated approach to the design of complex engineering systems.
- ii) To provide knowledge of sensors, actuators and their selection for an application.
- iii) To expose interfacing of devices with controllers.
- iv) To understand the Intelligent Mechatronics.

10. Course Outcomes (COs):

- i) Identify the elements of mechatronics system.
- ii) Select suitable sensors and actuators to meet specific requirements.
- iii) Select the controllers according to the need.
- iv) Demonstrate intelligent mechatronics system for engineering applications.

11. Lab Component

Sr. No.	Title	COs covered
1	Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion.	i), ii), iii), iv)
2	Stepper motor interface.	i), ii), iii), iv)
3	Traffic light interface.	i), ii), iii), iv)
4	Speed control of DC motor.	i), ii), iii), iv)

5	Study of various types of transducers.	i), ii), iii), iv)
6	Study of hydraulic, pneumatic and electro-pneumatic circuits.	i), ii), iii), iv)
7	Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.	i), ii), iii), iv)
8	Study of PLC and its applications.	i), ii), iii), iv)
9	Study of image processing technique temperature control	i), ii), iii), iv)

2.	Course Name	Introduction to Electric and Hybrid Vehicles	L		Т		Р	
		Lab						
3.	Course Code		0		0		2	
4.	Type of Cours	se (use tick mark)	Core ()	PE (✔)		OE ()		
5.	Pre-requisite (6. Frequency (use	Even ()	Odd	Either	Every	
	any)	Automobile	tick marks)		(✔)	Sem ()	Sem ()	
		Engineering						
7.		of Lectures, Tutorials, P	_	-		·)		
	$\frac{\text{ctures} = 0}{C}$	·	Tutorials = 0	Practica	al = 28			
	Course Descri				<u></u>			
Th	e material for th	ices the fundamental conception is course will be prepared a pers and final year undergrade	in such a manner that it	-				
			nicles					
	 iv) Know about Course Outcoot i) Describe at ii) Explain the iii) Understand iv) Describe the 	at the control in Electric Ve <u>ut the Hybrid Vehicles.</u> mes (COs): On successful about working principle of e construction and working d about working principle o he different types and working	completion of this course electric vehicles. principle of various moto f electronics and sensor l	ors used in e ess control	electric ve	hicles.		
11	 iv) Know about Course Outcon i) Describe a ii) Explain the iii) Understand iv) Describe the Lab Content 	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e e construction and working d about working principle o he different types and working	completion of this course electric vehicles. principle of various moto f electronics and sensor l	ors used in e ess control	electric ve	hicles. vehicles		
11	 iv) Know about Course Outcon i) Describe a ii) Explain the iii) Understand iv) Describe the Lab Content 	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e e construction and working d about working principle o	completion of this course electric vehicles. principle of various moto f electronics and sensor l	ors used in e ess control	electric ve	hicles. vehicles	ered	
11	iv)Know aboutCourse Outcoursei)Describe aii)Explain theiii)Understandiv)Describe thLab Content. No.	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e e construction and working d about working principle o he different types and working	completion of this course electric vehicles. principle of various mote of electronics and sensor l ing principle of hybrid ve	ors used in e ess control	electric ve	hicles. vehicles	_	
11	iv) Know about Course Outcout i) Describe at ii) Explain the iii) Understand iv) Describe th Lab Content No. 1 1 1	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e e construction and working d about working principle o he different types and working Fitle	completion of this course electric vehicles. principle of various moto of electronics and sensor l ing principle of hybrid ve nents of electric car.	ors used in e ess control	electric ve	hicles. vehicles	ered	
11	iv)Know aboutCourse Outcoursei)Describe aii)Explain theiii)Understandiv)Describe thLab ContentNo.127	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e construction and working d about working principle o he different types and working Fitle To Study of various component	completion of this course electric vehicles. principle of various moto if electronics and sensor l ing principle of hybrid ve nents of electric car.	ors used in e ess control ehicles.	electric ve	hicles. vehicles	ered i)	
11	iv)Know aboutCourse Outcorei)Describe aii)Explain theiii)Understandiv)Describe thLab ContentNo.1237	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e construction and working d about working principle o he different types and working Fitle To Study of various compor To Study of wiring layout o	completion of this course electric vehicles. principle of various moto if electronics and sensor l ing principle of hybrid ve ments of electric car. of electric vehicle. three-phase induction m	ors used in e ess control chicles.	electric ve	hicles. vehicles	ered i) i)	
11	iv)Know aboutCourse Outcoursei)Describe aii)Explain theiii)Understandiv)Describe thLab ContentNo.1234	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e construction and working d about working principle o he different types and working Fitle To Study of various compore To Study of wiring layout of To study the V/f control of	completion of this course electric vehicles. principle of various moto if electronics and sensor I ing principle of hybrid ve nents of electric car. of electric vehicle. three-phase induction n I of BLDC motor in two-v	ors used in e ess control chicles. notor. vheeler.	electric ve	hicles. vehicles	ered i) i) i)	
11	iv)Know aboutCourse Outcoursei)Describe aii)Explain theiii)Understandiv)Describe thLab ContentNo.11234576	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e construction and working d about working principle o he different types and working Fitle To Study of various compore To Study of wiring layout of To study the V/f control of To Study the Speed control	completion of this course electric vehicles. principle of various moto if electronics and sensor I ing principle of hybrid ve nents of electric car. of electric vehicle. three-phase induction n I of BLDC motor in two-v	notor. wheeler.	electric ve in electric	hicles. vehicles	ered i) i) ii) iii)	
11	iv)Know aboutCourse Outcori)Describe aii)Explain theiii)Understandiv)Describe thLab ContentNo.112345761ir	ut the Hybrid Vehicles. mes (COs): On successful about working principle of e construction and working d about working principle o he different types and working Fitle To Study of various compore To Study of wiring layout of To Study the V/f control of To Study the Speed contro To Study the Speed contro To Study the Speed contro To study the Speed contro	completion of this course electric vehicles. principle of various moto if electronics and sensor I ing principle of hybrid ve nents of electric car. of electric vehicle. three-phase induction n I of BLDC motor in two-v I of SRM motor in three- Four quadrant operatior	notor. wheeler. of three-p	electric ve in electric	hicles. vehicles	ered i) i) ii) iii)	
11	iv)Know aboutCourse Outcori)Describe aii)Explain theiii)Understandiv)Describe thLab ContentNo.11234576177	ut the Hybrid Vehicles. mes (COs): On successful about working principle of a e construction and working d about working principle o he different types and working Fitle To Study of various compore To Study of various compore To Study of wiring layout of To Study the V/f control of To Study the Speed contro To study the Speed contro	completion of this course electric vehicles. principle of various moto if electronics and sensor I ing principle of hybrid ve nents of electric car. of electric vehicle. three-phase induction n I of BLDC motor in two-v I of SRM motor in three- Four quadrant operation	notor. wheeler. of three-p	electric ve in electric	hicles. vehicles	ered i) i) ii) iii) iii)	
11	iv)Know aboutCourse Outcori)Describe aii)Explain theiii)Understandiv)Describe thLab ContentNo.112345767787	ut the Hybrid Vehicles. mes (COs): On successful about working principle of a e construction and working d about working principle o he different types and working Fitle To Study of various compore To Study of various compore To Study of wiring layout of To Study the V/f control of To Study the Speed contro To study the Speed contro	completion of this course electric vehicles. principle of various moto f electronics and sensor I ing principle of hybrid ve nents of electric car. of electric vehicle. three-phase induction n I of BLDC motor in two-v I of SRM motor in three- Four quadrant operation uators in an Electric Vehic ion motor.	notor. wheeler. of three-p	electric ve in electric	hicles. vehicles	ered i) i) ii) iii) iii) iii)	

Department Electives-VI Lab

2. Cou	rse	Sensors &	L		Т		Р
Nan		Actuators Lab	_				-
3. Cou Cod			0	0 0			2
4. Typ	e of Cour	rse (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5. Pre- requ any	uisite (if	NIL	6. Frequency (use tick marks)	Even ()	Odd (🗸)	Either Sem ()	Every Sem ()
		r of Lectures, Tuto	rials, Practical (assu			ester)	
Lec	tures = 0		Tutorials = 0	Pract	ical = 28		
8. Cour	se Descri	ption					
	rning obj						
i) F ii) U iii) F iv) 7 10. Cou i) A ii) C iii) I	Be able to Jnderstand Be able to Co underst rse Outco Analyze va Conduct es nterpret th	determine the require d the operation of con analyze and select th and the design of var omes (COs): arious premises, appr speriments and meas an acquired data and		ensors and actuensors or actuanators. nd results relatory and on real	ted to sensors	and actuate sensors and	l actuators
 i) E ii) U iii) E iv) 7 10. Cout i) A ii) C iii) I iii) I iv) 7 	Be able to Jnderstand Be able to Co underst rse Outco Analyze va Conduct ex nterpret the Cake part i	determine the require d the operation of con analyze and select the and the design of var omes (COs): arious premises, appr appriments and meas he acquired data and in team work and be	mmonly employed se the most appropriate se rious sensors and actu- roaches, procedures a urements in laborator	ensors and actuensors or actuanators. nd results relatory and on real	ted to sensors	and actuate sensors and	l actuators.
 i) E ii) U iii) E iv) 7 10. Cout i) A ii) C iii) I iii) I iv) 7 	Be able to Jnderstand Be able to Co underst rse Outco Analyze va Conduct es nterpret th	determine the require d the operation of con analyze and select the and the design of var omes (COs): arious premises, appr appriments and meas he acquired data and in team work and be	mmonly employed se the most appropriate se trious sensors and actu- roaches, procedures a urements in laborator measured results.	ensors and actuensors or actuanators. nd results relatory and on real	ted to sensors	and actuate sensors and	l actuators
 i) F ii) U iii) F iv) 7 10. Cout i) A ii) C iii) I iv) 7 11. Lab 	Be able to Jnderstand Be able to Co underst rse Outco Analyze va Conduct ea Interpret th Cake part in Compon Title	determine the require d the operation of con analyze and select the and the design of var omes (COs): arious premises, appr appriments and meas he acquired data and in team work and be	mmonly employed se the most appropriate se rious sensors and actu- roaches, procedures a urements in laborator measured results. able to independently	ensors and actuensors or actuanators. nd results relatory and on real	ted to sensors	and actuate sensors and	COs covered
 i) E ii) U iii) E iv) 7 10. Cou i) A ii) C iii) I iv) 7 11. Lab Sr. No. 	Be able to Jnderstand Be able to Counderst rse Outco Analyze va Conduct ex- nterpret the Cake part in Compon Title Closed	determine the require d the operation of con- analyze and select the and the design of var- omes (COs): arious premises, appr xperiments and meas he acquired data and i in team work and be ent	mmonly employed se the most appropriate se rious sensors and actu- roaches, procedures a urements in laborator measured results. able to independently	ensors and actuensors or actua lators. nd results rela ry and on real present vario	ted to sensors	and actuate sensors and	COs covered i), ii), iii) iv)
 i) F ii) U iii) F iv) 7 10. Cou i) A ii) C iii) I iii) I iv) 7 11. Lab Sr. No. 	Be able to Jnderstand Be able to Counderst rse Outco Analyze va Conduct ex- nterpret the Cake part in Compon Title Closed	determine the require d the operation of con- analyze and select the and the design of var- omes (COs): arious premises, appr xperiments and meas he acquired data and i in team work and be ent	mmonly employed set the most appropriate set rious sensors and actu- roaches, procedures a urements in laborator measured results. able to independently ntrol	ensors and actuensors or actua lators. nd results rela ry and on real present vario	ted to sensors	and actuate sensors and	COs covered i), ii), iii) iv) i), ii), iii)

5	Brushless DC motor drive construction and closed loop linear positioning.	i), ii), iii), iv)
6	Shape memory alloy actuator closed loop linear positioning.	i), ii), iii), iv)

1.	Name of the D	Department- Mecha	anica	l Engineerin	g			
2.	Course	Design of		L	Т		Р	
	Name	Thermal System						
		Lab						
3.	Course Code			0	0		2	
4.	4. Type of Course (use tick mark)			Core ()	PE (✔)		OE ()	
5.	Pre-requisite	Engineering	6.	Frequenc	Even ()	Odd	Either	Every
	(if any)	Thermodynamic		y (use tick		(✔)	Sem ()	Sem ()
		s & Mechanical		marks)				
		Machine Design						
7.	Total Number	of Lectures, Tuto	rials	, Practical (a	ssuming	14 weeks	of one semes	ter)
	Lectures = 00		Tut	orials = 0	Pra	ctical = 2	8	

8. Course Description

The design of thermal systems requires an integrated approach that treats thermodynamics, fluid mechanics, and heat transfer as parts of one interconnected area, in which appropriate solutions to reallife design and analysis problems can be obtained only when all these aspects are considered simultaneously (after familiarity with these three topics is achieved in previous dedicated courses.) This approach must be implemented through open-ended problems and design project-oriented teaching. Topics related to thermal systems include fluid flow networks, heat exchanger design, design and selection of pumps, fans and compressors, heat recovery systems, psychometrics, air-conditioning systems, electronic cooling systems, fuels and combustion, solar thermal systems, and power plant design. This course is specifically designed to allay the fear of ill-defined problems by teaching the skills to model and translate a physical situation into the relevant equations. The use of equationsolving software facilitates the implementation of this focus by reducing the effort involved in solving equations and affording the opportunity for more discourse on the approach toward modeling of thermal systems. The students will learn the effect of individual component design on overall systems through parametric optimization studies. Topics common to the design of all thermal systems will be taught briefly in an interactive lecture format, but the main emphasis will be on open-ended design problems to be formulated and solved in discussion format. The course will begin with the development of skills for the modeling and parametric investigation of individual thermal system components. As proficiency is gained in these exercises, the students will develop the capability to design overall thermal systems in projects of larger scope. The methodology of translating a problem statement into design tasks and executing them will be illustrated. The understanding of thermal component and system design will be encouraged by requiring the students to view the "solution" to the problem as the beginning rather than the end of a design. Discussion of the effects of changes in design conditions (flow rates, inlet temperatures, etc.) and component geometry (diameter, length, other features) on performance will be emphasized.

9. Learning objectives:

- i) To learn overall design requirement and methodology of a thermal system.
- ii) To learn tools and techniques of analysis of a thermal system.
- iii) How to do modeling of a thermal system.
- iv) To techniques of economic analysis of thermal system.
- v) How to do optimization of a thermal system.

10. Course Outcomes (COs):

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- i) Students should be able to have knowledge of different aspects of designing of a thermal system.
- ii) Students should be able to identify and examine a design problem associated to a thermal system.
- iii) Students should be able to understand basics of modeling and their associated techniques.
- **iv**) Students should be able to explain economic aspect of designing and able to apply different techniques of optimization applicable to thermal system.
- v) Students should be able to explain the most optimal solution for thermal performance of such systems.

Sr. No.	Title	COs Covered
1.	2-D Thermal analysis on a rectangular plate.	i)
2.	Thermal analysis on a furnace wall consists of two layers.	i), ii)
3.	Thermal analysis on a mild steel tank which contain water.	ii), iii)
4.	Thermal analysis on wall which contain brick, foam and wood.	i), ii)
5.	Laminar pipe flow.	iii)
6.	Turbulent pipe flow.	iii), iv), v)

I. N	Name of th	c Dopul intene mice	hanical Engineeri	ng			
	Course Name	Non- Conventional Machining Lab	L		Τ		Р
	Course Code		0		0		2
4. 7		ourse (use tick	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
1	Pre- requisite (if any)	Fundamentals of Machining Processes	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Nun	ber of Lectures, Tu	torials, Practical	(assuming 1	4 weeks o	f one sem	ester)
]]	Lectures =	= 00	Tutorials = 0	Pract	ical = 28		
manu manu wher 9. L i) ii ii ii	ufacturing ufacturing re non-com Learning o) To Ac manufa ii) To Acq manufa v) To Ac manufa	rriculum. Students v process known a is designed to prepa ventional machines a bjectives: Students u quire a functional cturing equipment. quire a functional un cturing equipment. quire a functional cturing equipment. quire a functional cturing equipment. quire a functional cturing equipment.	as non-conventio re interested studer re used. undergoing this cou understanding of derstanding of Ele understanding of understanding of	nal manuf nts for futur rse are expe f Electrical ectro-Chemi of Thermal Mechanica	acturing. re careers f ected to: Energy cal Energy Energy I Energy	The non manufactur based no y based no based no	conventional ring industry on-traditional on-traditional on-traditional
10. C i)) To perfe	tcomes (COs): On co	1				
ii iv	ii) To perfprocess.v) To perf	orm the machining op orm the machining o orm the machining op	eration using Electroperation using ultr	ro-Chemica rasonic mac	l and Chem hining and	ical machi laser bear	ning process. n machining
ii iv	 i) To perfect ii) To perfect process. v) To perfect Lab Comp 	orm the machining op orm the machining of orm the machining op onent	eration using Electroperation using ultr	ro-Chemica rasonic mac	l and Chem hining and	ical machi laser bear achining p	ning process. n machining
ii iv 11. l	i) To perfo ii) To perfo process. v) To perfo Lab Comp No. Tit	orm the machining op orm the machining of orm the machining op onent	eration using Electroperation using ultroperation using wate	ro-Chemica rasonic mac	l and Chem hining and	ical machi laser bear achining p	ning process. m machining process.
ii iv 11. l Sr. N	i) To perfo ii) To perfo process. v) To perfo Lab Comp No. Titl I Ele	orm the machining op orm the machining of orm the machining op onent e	eration using Electroperation using ultroperation using wate	ro-Chemica rasonic mac	l and Chem hining and	ical machi laser bear achining p	ning process. m machining process. Ds covered

4	Electron Beam machining	i)
5	Abrasive Jet Machining	iv)
6	Water Jet Machining	iv)
7	Ultra-Sonic Machining	iii)
8	Chemical Machining	ii)
9	Abrasive Water Jet Machining	iv)
10	Photo Chemical Milling	ii)
11	Electro Jet Drilling	i)

2.	Cours	se Name	Mechanism & Manipulator Design Lab	L		Т		Р
3.	Cours	se Code		0		0	2	
4.	Туре	of Course (u	se tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5.	Pre-re any)	equisite (if	Engineering Mechanics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total	Number of I	Lectures, Tutorials, Practical		eks of one	e semester)	
Le	ctures	= 0		Tutorials = 0	Practic	cal = 28		
8.	Cours	e Description	n					
			sically kinematics of Robots coordinates of Robots coordinates and a second structure of the second se		-		-	s, chains.
10.	 Cours i) U ii) U iii) U 	se Outcomes nderstand the nderstand the nderstand the	the motion planning of the rob (COs): links, pairs and chains. different mechanisms uses in anatomy of manipulators. basic design and dynamics of	machines.				
11.	. Lab (Component					_	
Sr.	No.	Title					COs cov	vered
	1		bus types of linkage mechanis study the relevant effects.	sm in CAD and si	imulate f	or motion	i),	ii)
	2		various joints like revolute, pla f freedom and motion patterns	•	follower	and study	i),	ii)
	3	U	cam profile by using the requir			ngineering	i),	ii)
	4	Simulations of Gears and Gear trains in Solidworks i), ii)						ii)
								11)
	5				ons.			
	5	Modeling an	of Gears and Gear trains in So	ism and its inversion		ions.	i),	

8	Acceleration and velocity analysis of single slider crank mechanism	i), ii)
9	Acceleration and velocity analysis of double slider crank mechanism	i), ii)
10	To study of robot anatomy.	iii), iv)
11	To study different types of robots.	iii)
12	To study Denavit- Hartenberg parameters of Robotics.	iii), iv)

2. Cours	of the Department- Mee e Engine Design	L		Т		Р
Z. Cours Name	8 8	L		I		1
3. Cours		0		0		2
Code						
4. Type	of Course (use tick	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
mark)					
5. Pre-	IC Engines	6. Frequency	Even ()	Odd (✔)	Either	Every
requi		(use tick			Sem	Sem
(if an		marks)			0	0
	Number of Lectures, T				semester)	
	res = 0	Tutorials = 0	Pract	ical = 28		
	e Description					
	e develops competence i	•••	•	•		•
	ho are interested in design	ning, testing, analyzing	, or controlli	ng next gener	ration IC engir	ne systems.
	ing objectives:					
	make students familiar v	vith the design and ope	rating charac	cteristics of m	odern internal	combustion
	gines.					
	apply analytical technique	ues to the engineering p	problems and	l performance	analysis of in	ternal
	nbustion engines.					
	study the thermodynami		ansfer, frictio	on and other f	actors affectin	g engine
-	wer, efficiency and emiss					
	introduce students to the	environmental and fue	el economy c	challenges fac	ing the interna	l
	nbustion engine.					
	e Outcomes (COs): The	curriculum of the Dep	partment is de	esigned to sat	isfy the divers	e needs of
studei						
	ferentiate among different					
	cognize and understand	reasons for differences	among ope	rating charact	teristics of dif	ferent engine
• •	es and designs					
	arn to compare and cont	-			, and to attrib	ute observed
	crepancies to either meas		•			
	velop an ability to optir	nize future engine des	igns for spe	cific sets of	constraints (fu	iel economy,
	formance, emissions)					
11. Lab (
Sr. No.	Title				CO	s covered
1	Performance test on Ga					i), iv)
2	Performance & emission		engine			i), iv)
3	Performance & emission					i), iv)
4	Swirl & Flow tests of p	orts on steady state flo	w-bench.			i), ii), iii)
5	Designing automobile	parts and assemblies us	ing Software	es.		i), ii), iii)
6	Stress Analysis of auto			software		i), ii), iii)
7	Manufacturing Simulat					

2.				Ingineering	-			
	Course Name		Battery	L	Т		Р	
			Management					
-	<u> </u>	1	System Lab	0	0		-	
3. Course Code				0	0		2	
4.	Type of Cou			Core ()	PE (✓)	OE ()		
5.	Pre-requisit	e (if	Introduction to	6. Frequency (use	Even Odd ()	Either	Every	
	any)		Electric and	tick marks)	(✔)	Sem ()	Sem ()	
7	Total Numb	orofI	Hybrid Vehicles	nactical (accuming 14 way	les of one comeste			
	$\frac{10 \tan Numb}{10 \tan Numb}$		ectures, rutoriais, ri	ractical (assuming 14 wee Tutorials = 0	Practical = 28	(1)		
8.	Course Des	crintion		1 utor rais = 0	Tractical – 20			
		-		pts, principles, analysis and	l design of hybrid	and electric	- vehicle	
			-	in such a manner that it w				
			id final year undergrad		in be useful for pe	St graduat	e studena	
	-		s: The objective of thi					
-	i)	•	e	of Battery Management Sy	/stem			
	ii)		v 1	ries, its parameters and mo				
	iii)			ries charging requirements	C			
	iv)	The	course will help learn	ner to develop battery mana	gement algorithm	s for batter	ies.	
10.	. Course Out	comes (COs): On successful	completion of this course,	the student will be	able to		
	i)	_						
	1)	Inter	rpret the role of batter	y management system				
	ii)		-	y management system ciated with battery chargin				
	,	Inter	rpret the concept asso		g / discharging pro			
	ii) iii) iv)	Inter Calc Desi	rpret the concept asso	ciated with battery chargin meters of battery and batter	g / discharging pro			
	ii) iii) iv) . Lab Conten	Inter Calc Desi t	rpret the concept associate the various para	ciated with battery chargin meters of battery and batter	g / discharging pro	ocess		
	ii) iii) iv)	Inter Calc Desi	rpret the concept associate the various para	ciated with battery chargin meters of battery and batter	g / discharging pro		Ds	
	ii) iii) iv) . Lab Conten	Inter Calc Desi t	rpret the concept associate the various para	ciated with battery chargin meters of battery and batter	g / discharging pro	CC)s vered	
	ii) iii) iv) . Lab Conten . No.	Inter Calc Desi t Title	rpret the concept assocuted the various para	ciated with battery chargin ameters of battery and battery ary pack	g / discharging pro	CC	vered	
	ii) iii) iv) . Lab Conten	Inter Calc Desi t Title	rpret the concept associate the various para	ciated with battery chargin ameters of battery and battery ary pack	g / discharging pro	CC		
	ii) iii) iv) . Lab Conten . No.	Inter Calc Desi t Title To Stu	rpret the concept associate culate the various para ign the model of batte dy of different types of	ciated with battery chargin ameters of battery and battery ary pack	g / discharging pro ery pack	CC	vered	
	ii) iii) iv) . Lab Conten . No.	Inter Calc Desi t Title To Stu To Stu	rpret the concept assocutate the various para ign the model of batte dy of different types of dy Battery monitoring	ciated with battery chargin meters of battery and battery ry pack of batteries. g System for Lead acid bat	g / discharging pro ery pack	CC	i)	
	ii) iii) iv) . Lab Conten . No.	Inter Calc Desi t Title To Stu To Stu	rpret the concept assocutate the various para ign the model of batte dy of different types of dy Battery monitoring	ciated with battery chargin meters of battery and battery ry pack	g / discharging pro ery pack	CC	i)	
	ii) iii) iv) . Lab Conten . No.	Inter Calc Desi t To Stu To Stu To Stu	rpret the concept assocutate the various para ign the model of batte dy of different types of dy Battery monitoring	ciated with battery chargin umeters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery.	g / discharging pro ery pack	CC	i)	
	ii) iii) iv) . Lab Conten . No. 1 2 3 4	Inter Calc Desi t Title To Stu To Stu To stuc Analys	rpret the concept assoculate the various para ign the model of batte dy of different types of dy Battery monitoring dy for passive cell bal sis of Electric vehicle	ciated with battery chargin meters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery. power system.	g / discharging pro ery pack tery.		i) i) i) ii)	
	ii) iii) iv) . Lab Conten . No. 1 2 3	Inter Calc Desi t Title To Stu To Stu To stud Analys	rpret the concept asso- culate the various para ign the model of batte dy of different types of dy Battery monitoring dy for passive cell bal sis of Electric vehicle form Short Circuit Te	ciated with battery chargin umeters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery.	g / discharging pro ery pack tery.		vered i) i) i)	
	ii) iii) iv) . Lab Conten . No. 1 2 3 4 5	Inter Calc Desi t To Stu To Stu To Stu To Stu Analys To Per AIS 04	rpret the concept asso- culate the various para ign the model of batte dy of different types of dy Battery monitoring dy for passive cell bal sis of Electric vehicle form Short Circuit Te 8 standard.	ciated with battery chargin meters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery. power system. est for traction batteries (Le	g / discharging pro ery pack tery.	CC CO CO S per	i) i) i) ii) iii)	
	ii) iii) iv) . Lab Conten . No. 1 2 3 4	Inter Calc Desi t To Stu To Stu To Stu To Stu Analys To Per AIS 04	dy of different types of dy of different types of dy for passive cell bal sis of Electric vehicle form Short Circuit Te 8 standard. form Overcharge Tes	ciated with battery chargin meters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery. power system.	g / discharging pro ery pack tery.	CC CO CO S per	i) i) i) ii) iii)	
	ii) iii) iv) . Lab Conten . No. 1 2 3 4 5	Inter Calc Desi t To Stu To Stu To Stu To Stu Analys To Per AIS 04 To Per AIS 04	dy of different types of dy of different types of dy for passive cell bal sis of Electric vehicle form Short Circuit Te 8 standard. form Overcharge Tes 8 standard.	ciated with battery chargin meters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery. power system. est for traction batteries (Lea t for traction batteries (Lea	g / discharging pro ery pack tery. tery. ead-Acid/Li-ion) a d-Acid/Li-ion) as	S per per	i) i) i) ii) iii)	
	ii) iii) iv) . Lab Conten . No. 1 2 3 4 5 6 7	Inter Calc Desi t Title To Stu To Stu To Stu Analys To Per AIS 04 To Per AIS 04	dy of different types of dy of different types of dy Battery monitoring dy for passive cell bal sis of Electric vehicle form Short Circuit Te 8 standard. form Overcharge Tes 8 standard. dy Coulomb counting	ciated with battery chargin meters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery. power system. est for traction batteries (Lea method for Lead-Acid bat	g / discharging pro ery pack tery. ead-Acid/Li-ion) a d-Acid/Li-ion) as tery and Li-ion ba	CCC COV COV COV COV COV COV COV COV COV	i) i) i) ii) iii) iii) iii)	
	ii) iii) iv) . Lab Conten . No. 1 2 3 4 5 6	Inter Calc Desi t Title To Stu To Stu To Stu Analys To Per AIS 04 To Per AIS 04	dy of different types of dy of different types of dy Battery monitoring dy for passive cell bal sis of Electric vehicle form Short Circuit Te 8 standard. form Overcharge Tes 8 standard. dy Coulomb counting	ciated with battery chargin meters of battery and battery ry pack of batteries. g System for Lead acid bat ancing for Li-Ion battery. power system. est for traction batteries (Lea t for traction batteries (Lea	g / discharging pro ery pack tery. ead-Acid/Li-ion) a d-Acid/Li-ion) as tery and Li-ion ba	CCC COV COV COV COV COV COV COV COV COV	vered i) i) i) ii) ii) ii) ii)	

6th Semester

1. Name of the I	Department- Mechanic	cal Engineering				
2. Course	Heat and Mass	L	Т		Р	
Name	Transfer					
3. Course		3	0		0	
Code						
4. Type of Cours	se (use tick mark)	Core (✔)	PE ()		OE ()	
5. Pre-	Engineering	6. Frequency	Even (🗸)	Odd ()	Either Sem	Every
requisite (if	Thermodynami	(use tick			0	Sem ()
any)	cs	marks)				
7. Total Number	r of Lectures, Tutorial	ls, Practical (assun	ning 14 weel	ks of one se	mester)	
Lectures = 42		Tutorials = 0	Pract	ical = 0		
8. Course Descr	iption					
An introductory co	ourse in heat and mass the	ransfer covering co	nduction, co	nvection an	d radiation heat	t transfer,
principles of heat e	exchanger and mass tran	nsfer. Heat transfer	and mass tra	insfer are ki	netic processes	that may
occur and be studie	ed separately or jointly.	Studying them apa	rt is simpler	, but both p	rocesses are mo	odeled by
similar mathematic	cal equations in the case	e of diffusion and co	onvection (th	nere is no m	ass-transfer sin	nilarity to
heat radiation), and	d it is thus more efficien	nt to consider them	jointly			
9. Learning obje	ectives:					
i) To comprel	hend and evaluate vario	ous modes of heat an	nd mass trans	sfer		
ii) To design f	fin enhanced systems, e	vaporators, condens	sers and heat	exchangers		
iii) To understa	and boundary layer theo	ory, condensation a	nd boiling.			
iv) To determine	ne effectiveness of heat	exchangers using I	LMTD and N	ITU.		
10. Course Outco	omes (COs): On comple	etion of this course,	the students	will be able	e to	
i) Apply	basic principles of fluid	d mechanics, therm	odynamics,	heat transfe	r for designing	heat and
mass tr	mass transfer systems.					
ii) Model	heat, mass and moment	tum transport system	ns and devel	op predictiv	ve correlation.	
iii) Assess	and evaluate various de	esigns for heat and	nass transfer	r and optimi	ze the solution	
iv) Apply	the basic principles of l	heat exchanger app	lications.			
11. Unit wise deta	and content					
Unit-1	Number of	Title of the u	mite Condu	ation I		
Umt-1	lectures = 11	The of the t	init: Condu	cuon - 1		
Pagia concenta d		n and radiation	awa Can	aral aquatic	n of host con	duction
Basic concepts – conduction - convection and radiation – Laws – General equation of heat conduction –						
Derivation in Cartesian and cylindrical - One dimensional steady state heat conduction in simple geometries –						
plane wall – cylinder and sphere – Heat transfer composite walls - composite cylinders and composite spheres						
 Critical thickness of insulation –Thermal contact resistance – Overall heat transfer coefficient – Electrical analogy – Heat generation in plane wall - cylinder and sphere – Extended surfaces – general equations 						
	-	·		-	eneral equation	15
Unit – 2	Number of	Title of the u	init: Condu	ction – 11		
True and Thurs 1'	lectures = 10			Turo m la la sa 1	. J. NT	• • 4 h • • ¹ •
Two- and Three-dimensional steady state heat conduction – Analytical - Graphical and Numerical methods –						
Unsteady state heat conduction – Lumped parameter system – Non-dimensional numbers in conduction –						
Significance of Biot and Fourier numbers -Types and applications of fins – Fin efficiency and effectiveness –						
Fin performance. Unit - 3 Number of Title of the unit: Convection						
Unit – 3	Number of	Title of the u	init: Conveo	ction		
	lectures = 10					

Boundary layer theory – Conservation equations of mass - momentum and energy for laminar flow over a flat plate – Turbulent flow over a flat plate –Internal flow through pipes – annular spaces – Analogy between momentum and heat transfer – Natural convection in vertical Dimensional analysis.

Unit	_	4	Number of Title of the unit: Condensation, Boiling and Radiation	
			lectures = 11	Heat Exchanger

Condensation and Boiling – Film wise and Drop wise condensation – Film condensation on a vertical plate – Regimes of Boiling –Forced convection boiling – Radiation heat transfer – Thermal radiation –Laws of radiation – Black body concept – Emissive power – Radiation shape factor – Gray bodies – Radiation shields. Heat Exchangers – Types and practical applications – Use of LMTD – Effectiveness – NTU method – Compact heat exchangers – Plate heat exchangers – Fouling factor – Heat pipes – Types and applications.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

sound pupers, rucents in the respective nerd.					
13. Books Recommended					
Text Books					
i)	R. C. Sachdeva (2005), Fundamentals of Heat and Mass Transfer, New Age International (P) Ltd.				
	ISBN: 978-8-122-40076-2.				
ii)	P. K. Nag (2005), Heat Transfer, Tata McGraw Hill Publishing Company Limited. ISBN: 978-0-				
	070-60653-1.				
Reference Books:-					
i)	J. P. Holman (2005), Heat Transfer, 9th Edition, McGraw-Hill Publishing Company Limited.				
	ISBN: 978-0-070-29618-3.				
ii)	Dewitt Lavine, Bergmann and Incropera (2010), Fundamentals of Heat and Mass Transfer, 6th				
	Edition, John Wiley & Sons, ISBN: 978-8-126-52764-9.				
iii)	M. Necat Ozisik, Helcio R.B. Orlande (2021), Inverse Heat Transfer: Fundamentals and Applications,				
	2 nd Edition, CRC Press, Taylor & Francis, ISBN 9780367820671.				
iv)	Abram S. Dorfman, (2010), Conjugate Problems in Convective Heat Transfer, 1st Edition, CRC Press,				
	Taylor & Francis, ISBN 9781138372719.				
v)	S. Mostafa Ghiaasiaan, (2018), Convective Heat and Mass Transfer, 2 nd Edition, CRC Press, Taylor &				
	Francis, ISBN 9780815361411.				

1.	Name of the Depart	tment- Mechanical E	Ingineering					
2.	Course Name	Dynamics of	L	Т		Р		
		Machines						
3.	Course Code		3	0		0		
4.	Type of Course (use	e tick mark)	Core (✓)	PE ()	PE () C		OE ()	
5.	Pre-requisite (if	Kinematics of	6. Frequency (use	Even	Odd ()	Either	Eve	
	any)	Machines	tick marks)	(✔)		Sem ()	ry	
							Sem	
							0	
7.	Total Number of L	ectures, Tutorials, P	ractical (assuming 14 we	eks of one	semester)		
Le	ctures = 42		Tutorials = 0	Practica	al = 0			
8.	Course Description							
Dy	namic loads and under	sired oscillations incre	ease with higher speed of 1	nachines. A	At the same	e time, ind	lustrial	
	• •		tion. This course covers J				•	
		U	s, vibration isolation, and	•				
	-	• • • •	dynamic effects, such as		•		•	
	-		ed vibrations are covere	-		-	-	
	•	•	e the effect of dynamic for	orces on sy	stems and	try to min	nimize	
	negative impact of su							
9.	Learning objectives	5:						
		-	ng moment diagrams, fl	wheel de	sign and t	he dynam	nics of	
	reciprocating en	•						
		• •	es for rotating and recipro	ocating ma	sses, rotors	s and engin	nes.	
	iii) To understand the	ne fundamentals of fre	e and forced vibrations.					
	iv) To understand the	ne mechanisms for con	ntrol.					
10	. Course Outcomes (COs): After the comp	oletion of the course, the s	tudent sha	ll be able t	0		
	i) Demonstrate ski	lls to design flywheel	for an IC engine and pur	ching pres	s with the	considerat	tion of	
	geometrical and	economical constrain	ts.					
	ii) Perform static an	nd dynamic balancing	of high-speed rotary and	reciprocati	ing machir	nes.		
	iii) Analyze free and	d forced vibrations of	machines, engines and str	uctures.				
	iv) Apply the conce	pt of governors for sp	eed control.					
11	. Unit wise detailed c	content						
Un	it-1	Number of	Title of the unit: Dyna	mic Force	Analysis			
		lectures = 11						
D'	Alembert's principle,	Equivalent offset iner	rtia force, Dynamic analy	sis of four	bar mech	anism, Dy	namic	
An	alysis of reciprocatin	ng engines, Piston ef	fort, Crank effort, turnin	g moment	on crank	shaft, Ine	rtia of	
cor	nnecting rod, Inertia fo	orce in reciprocating e	engines (Graphical metho	d). Turning	moment of	liagrams,	Single	
and	l multi-cylinder engin	es, Fluctuation of ene	rgy, Flywheels, Applicati	ons in eng	ines and p	unching pr	resses.	
Un	it – 2	Number of	Title of the unit: Balar	cing				
		lectures = 10		0				
Sta	tic and Dynamic ba	alancing of rotating	masses, balancing of	eciprocati	ng masses	s, Balanci	ing of	
	•		g masses, Multi cylinder I	-	0		-	
	it – 3	Number of	Title of the unit: Vib		-		eedom	
					2 3			
		lectures = 10	Systems					
	roduction to vibration.		Systems fication of vibrations, Uno	lamped and	d Damped	free vibra	tion of	

	ic excitation, Ma		· · · · · · · · · · · · · · · · · · ·
Unit – 4	4	Number of	Title of the unit: Mechanism for Control
		lectures = 11	
Functio	ns of Governors,	Gravity controlled a	nd Spring controlled governor characteristics. Stability, Hunting
and Iso	chronisms. Effect	of friction, Calcula	tion of equilibrium speeds and ranges of speed of governors.
12. Bri	ef Description of	f self-learning / E-l	earning component
The stu	dents will be enco	ouraged to learn usin	ng the SGT E- Learning portal and choose the relevant lectures
delivere	ed by subject exp	erts of SGT Univers	ity.
The linl	k to the E-Learnin	ng portal.	
http://sg	<u>gtlms.org</u>		
		n the respective field	1.
Journal		*	1.
Journal	papers; Patents in bks Recommend	*	1.
Journal 13. Boo Text Bo	papers; Patents in oks Recommend	ed	
Journal 13. Boo Text Bo	papers; Patents in oks Recommend	ed	
Journal 13. Boo Text Bo i)	papers; Patents in oks Recommend ook S.S. Rattan (200	ed	l. nines", 3 rd Edition, Tata McGraw-Hill. ISBN: 978-0-070-14477-
Journal 13. Boo Text Bo i) Referen i)	papers; Patents in oks Recommend ook S.S. Rattan (200 4. nce Books A.Ghosh (2009)	ed 9), "Theory of Macl	
Journal 13. Boo Text Bo i) Referent i)	papers; Patents in oks Recommend ook S.S. Rattan (200 4. nce Books A.Ghosh (2009) Delhi, ISBN: 97	ed 9), "Theory of Macl , Theory of Mechan 8-8-185-93893-6.	nines", 3 rd Edition, Tata McGraw-Hill. ISBN: 978-0-070-14477-
Journal 13. Boo Text Bo i) Referent i)	papers; Patents in oks Recommend ook S.S. Rattan (200 4. nce Books A.Ghosh (2009) Delhi, ISBN: 97	ed 9), "Theory of Macl , Theory of Mechan 8-8-185-93893-6.	nines", 3 rd Edition, Tata McGraw-Hill. ISBN: 978-0-070-14477- isms and Machines, 3 rd Edition, East-West Press Pvt. Ltd., New
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Journal 13. Boo Text Bo i) Referen i) ii)	papers; Patents in bks Recommend ook S.S. Rattan (200 4. nce Books A.Ghosh (2009) Delhi, ISBN: 97 Thomas Bevan (16) 6. Kenneth J Waldu	ed 9), "Theory of Macl , Theory of Mechan 8-8-185-93893-6. 2009), Theory of Ma	nines", 3 rd Edition, Tata McGraw-Hill. ISBN: 978-0-070-14477 isms and Machines, 3 rd Edition, East-West Press Pvt. Ltd., Nev achines, 3 rd Edition, Pearson Education, ISBN: 978-8-131-72965

Department Electives-VII

1.	Name of the I	Department- Mechai	nical Engineering				
2.	Course Name	Pneumatics & Control	L		Т		Р
3.	Course Code		3		0		0
4.	Type of Cour	rse (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5.	Pre- requisite (if any)	NIL	6. Frequency (use tick marks)	Even (🗸)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Numbe	r of Lectures, Tutor	rials, Practical (assum	ing 14 weeks	s of one seme	ester)	
	Lectures = 42	2	Tutorials = 0	Practio	cal = 0		
8.	Course Descr	ription	1				
dev tran 9.	 elopment of en sfer of technolo Learning obj i) Study abou ii) To underst iii) To study th iv) To underst Course Outco i) Able to use ii) Optimize t 	gineering solutions in ogy. ectives: at use of Pneumatics and the various Robo he Robot path and spe- and the mechanical do omes (COs): e the concept of pneu- he robot path and app	e	rms f robot throug having knowl	the hyperbolic tension of	tivity, inno	ems.
	engineerin	g and control of robo	ts.	-	C		-
	iv) Get a pract	<u>^</u>	life problems in roboti	c control.			
U	nit-1	Number of lectures = 10	Title of the unit: Pn	neumatics			
Pne	Introduction, Air Control Valves, Pneumatic Actuators, Pneumatic Circuit Design Considerations, Basic Pneumatic Circuit: Operation of Single & Double Acting Cylinder, Air Pilot Control of Double Acting Cylinder. Pneumatic actuators and its control: case studies.						
U	nit – 2	Number of lectures = 10	Title of the unit: Me	echanical des	igning of rol	oots	
Pur	pose, Differenti	al transformation and	Optimal Design of a l velocity of a frame: D hial trajectory, Biped tra	erivative of a			

Unit – 3	Number of	Title of the unit: Robotic control
	lectures = 11	

Lagrangian method, Robot dynamics equation, Control: Robot dynamics equation as a control system, Trajectory tracking control, PD controller, Neural network control design. Redundancy Resolution of Human Fingers using Robotic Principles, Manipulability Analysis of Human Fingers during Coordinated Object Rotation, Kinematics of Flexible Link Robots

Unit – 4	Number of	Title of the Unit: Case study
	lectures = 11	

Robot Assisted Needling System for Percutaneous Intervention-An Introduction, Smart Robotic Needles for Percutaneous Cancerous Interventions, Robust Force Control of a Two Finger Exoskeleton during Grasping, Neural Control of an Index Finger Exoskeleton

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

 Introduction to Robotics: Analysis, Control, Applications by Saeed Benjamin Niku, John Wiley & Sons, Inc. ISBN: 978-1-119-52760-2

Reference Books

- i) Introduction to Robotics: Mechanics and Control by John J. Craig, Pearson Education International, ISBN 978-0201543612
- ii) Richard Paul, Robot Manipulators: Mathematics, Programming and Control, MIT Press, 1981, ISBN 9780262160827

		Department- Mechanic	al Engineer	ing				1	
2.	Course	Power Plant]	Ĺ			Т]	P
	Name	Engineering							
3.	Course			3	0		0		
	Code								
4.	Type of Cou	rse (use tick mark)	Core	0		PE (✓)	OE ()	
5.	Pre-	Engineering	6. Frequ	-	Even	(✓)	Odd ()	Either Sem	Every
1	requisite	Thermodynamics	(use tick m	arks)				0	Sem
									0
		er of Lectures, Tutorial			-	veeks			
	Lectures = 4]	futoria	$\mathbf{s} = 0$		Practical =	0	
	Course Desc	-							
	-	eering course is concerne		-					
		ntional and non-convent	-	-				-	
-		erformance of various co	-		•		•		•
-		e also focusses on varie		-	-	-		-	
		ng towers, fuel and air h		-					
		to have a proper underst	-						
		nergy produced in world	-	-		power	plants. The	e syllabus also	o covers
		nt in detail which is a nee	ed of current	scenario).				
9. I	Learning Ob								
ij		students about the workin	-					•	
i		ace students to steam gen			and firi	ng me	ethods in orc	ler to make th	e fullest
		rmal power potentialities		•					
		students, understand in o			•		· ·		
i		students, understand in o	detail about h	nydro ar	nd diese	l pow	er plants wł	nich play an in	nportant
	-	wer generation.							
		omes (COs): On complet				nts w	ill be able to	•	
ij) Understar	nd basic power generation	n types and st	eam cy	cles.				
		out the kind of boilers bei	0			s and	their applica	ability.	
	-	blems related to gas turbi		•					
i	-	sh between various powe	-	Module	s and cl	hoose	one that me	ets desired ec	onomic,
		ental and social requirem	ents.						
-		tailed content							
Uni		Number of lectures = 2						Power Plant	
	-	tures - Components and la	-		-		-		
and I	Diesel power	plants-Selection of site-A	analysis of st	eam cyc	les-Rar	hkine	cycle-Rehea	ting and Rege	nerative
cycle	es.								
Uni	it – 2	Number of lectures = 2		itle of tl iring M		: Stea	m Generate	ors, Combust	ion and
Boile	er classification	on-Types of Boiler-Fire to	ube and Wat	er tube l	oilers-	High	pressure and	Supercritical	boilers-
Posit	ive circulatio	on boilers-Fluidized bed b	oiler-Waste	heat rec	covery l	ooiler	Feed water	heaters-Super	heaters-
Rehe	aters-Econor	nizer-Condenser-Cooling	tower-Feed	water tr	eatmen	t-Air	heaters.		
		l preparation-Combustion							
		clone Furnace-Ash hand		Electro	static P	recipi	tator-Fabric	filter and Bag	g house-
Force	ed draft and I	nduced draft fans-Chimn	ey.						

Umt	- 3	Number of lectures = 10	Title of the unit: Nuclear and Gas Turbine Power
			Plants
Boilin	g water rea	ctor-Pressurized water reactor-Pre-	essurized Heavy Water Reactor-Gas cooled reactor-High
temper	rature gas c	cooled reactor-Pebble bed reactor	r-Fast breeder reactor-Liquid metal fast breeder reactor
reactor	r materials-	Radiation Shielding-Waste Disp	osal-Gas turbine power plant-Open and closed cycles
Interco	oling - Reh	eating and Regenerating-Combine	ed cycle power plant.
Unit	-4	Number of lectures = 11	Title of the unit: Hydro and Diesel Power Plants
Classi	fication of I	Hydro-electric power plants and th	heir applications-Selection of prime movers-Governing o
			d stopping-Heat Balance-Supercharging of Diesel engines
12. B	rief Descri	ption of self-learning / E-learnin	g component
The st	udents will	be encouraged to learn using the S	GT E-Learning portal and choose the relevant lectures
		ct experts of SGT University.	8 I
F1 1.			
		a a main a mantal	
The In	nk to the E-I	Learning portal.	
	nk to the E-I	Learning portal.	
<u>https://</u>	/sgtlms.org	Learning portal. tents in the respective field.	
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https:// Journa 13. B Text H i)	/sgtlms.org ll papers; Pa ooks Recor Books: R. K. Ra	tents in the respective field. mmended jput, (2007), A Text Book of Po ISBN 13: 9788131802557	ower Plant Engineering, Laxmi Publications (P) Ltd. 5 ^t
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https:// Journa 13. B Text H i) Refere i)	Asgtlms.org l papers; Pa ooks Recor Books: R. K. Ra Edition. D ence Books P. K. Na Company M.M. E	tents in the respective field. mmended jput, (2007), A Text Book of Po SBN 13: 9788131802557 ag, (2014), Power Plant Engineer / Ltd., 4 th EditionISBN13 9789339	ring: Steam and Nuclear, Tata McGraw-Hill Publishing 9204044.
https:// Journa 13. B Text H i) Refere i)	Asgtlms.org l papers; Pa ooks Recor Books: R. K. Ra Edition. P. K. Na Company M.M. E ISBN 13	tents in the respective field. mended ijput, (2007), A Text Book of Po ISBN 13: 9788131802557 ag, (2014), Power Plant Enginee / Ltd., 4 th EditionISBN13 9789339 - Wakil, (2010), Power Plant 7 : 9780072871029	ring: Steam and Nuclear, Tata McGraw-Hill Publishing 9204044.

2.	Name of th Course	Non-Destructive	L		Т		Р
	Name	Evaluation and					
		Testing					
		Testing					
3.	Course		3		0		0
	Code						
4.	Type of C	ourse (use tick mark)	Core ()	PE	OE	EAS ()	BSC ()
				(✔)	0		
5.	Pre-		6. Frequency	Even	Odd ()	Either Sem	Exami Sam (
	requisite		(use tick		Ouu ()		Every Sem (
	(if any)		(use tiek marks)	(✔)		0	
		her of Lectures, Tuto	,	uming 14 v	veeks of on	e semester)	
				U		,	
	Lectures =	= 42	Tutorials = 0	Practi	cal = 0		
8.	Course De	escription					
		vides students a synops	is of non-destructive	evaluation	and testing	methods used	in evaluation
	-	ncludes understanding			-		
	elus. This I	includes understanding	the basic principles c	or various in	D1 method	is with importa	ance,
	ications and	d limitations.					
	ications and	d limitations.					
appl							
appl	Learning	objectives:	estructive evaluation	methods th	at are used	in evaluation	of welds.
appl ⁱ 9.	Learning i) To lear	objectives: n non-destructive and d					of welds.
appl 9. i	Learning i) To lear ii) To und	objectives:	ple of non-destructive	e testing and	d fundamer	itals.	
appl 9. i i i	Learning i) To lear ii) To und iii) To und	objectives: n non-destructive and d erstand the basic princij	ple of non-destructive nethods used in non-	e testing and destructive	d fundamer testing and	itals. their limitation	
appl 9. i i i	Learning i) To lear ii) To und iii) To und	objectives: n non-destructive and d erstand the basic principerstand the inspection n	ple of non-destructive nethods used in non-	e testing and destructive	d fundamer testing and	itals. their limitation	
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appl 9. i i i 10.	Learning i) To lear ii) To und iii) To und iv) To expl Course O	objectives: n non-destructive and d erstand the basic princip erstand the inspection n lore the various factors utcomes (COs): On cou	ple of non-destructive nethods used in non- influences the non-de urse completion Stud	e testing and destructive estructive te ents will be	d fundamer testing and esting perfo	tals. their limitation rmance	
appl 9. i i i i i i	Learning i) To lear ii) To und iii) To und iv) To expl Course Ou i) To iden	objectives: n non-destructive and d erstand the basic princip erstand the inspection n fore the various factors utcomes (COs): On con tify different welding d	ple of non-destructive nethods used in non- influences the non-de urse completion Stud lefects through non-d	e testing and destructive te estructive te ents will be lestructive e	d fundamer testing and esting perfo e able to: examination	itals. their limitation rmance /testing.	
9. i i i i i i	Learning i) To lear ii) To unde iii) To unde iv) To expl Course Ou i) To iden ii) To iden	objectives: n non-destructive and d erstand the basic princip erstand the inspection n fore the various factors utcomes (COs): On cou- tify different welding d tify and use of each no	ple of non-destructive nethods used in non- influences the non-de urse completion Stud lefects through non-destructive testing	e testing and destructive te estructive te ents will be lestructive e equipment	d fundamer testing and esting perfo able to: examination with their a	ttals. their limitation rmance //testing. pplications.	
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appl 9. i i 10. i i 11. Un	Learning i) To lear ii) To unde iii) To unde iv) To expl Course Ou i) To iden ii) To iden ii) To iden iii) To sele iv) Have the fabricate Unit wise it-1	objectives: n non-destructive and d erstand the basic princip erstand the inspection n lore the various factors utcomes (COs): On cou- tify different welding d tify and use of each no ct the specific Code, Sta- te knowledge and essen- ion. detailed content Number of lectures = 10	ple of non-destructive nethods used in non- influences the non-de urse completion Stud lefects through non-de n-destructive testing andard, or Specificat tial skills to identify Title of the unit: I	e testing and destructive te estructive te ents will be lestructive e equipment ion related t strengths ar	d fundament testing and esting perfor able to: examination with their a to each testind weaknes	ttals. their limitation rmance //testing. pplications. ing method. ses in material	ns. Is used in
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Liquid Penetrate Testing – Principles, types and properties of liquid penetrates developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

Unit – 3	Number of lectures	Title of the unit: Thermography and eddy current testing
	= 10	

Thermography- Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation, infrared radiation and infrared detectors, Instrumentations and methods, applications.

Unit - 4Number of lecturesTitle of the unit: Eddy Current Testing & Radiography= 12

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors. Pentameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xerox-Radiography, Computed Radiography, Computed Tomography.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Baldev Raj, T. Jayakumar, M. Thavasimuthu (2009), "Practical Non-Destructive Testing", Wood Head Publishing, ISBN: 1855736004

Reference Books

- i) Ravi Prakash (2010), "Non-Destructive Testing Techniques", New Age International Private Limited; 1st edition, ISBN: 8122425887
 - ii) Chuck Hellier (2012), "Handbook of Non-Destructive Evaluation" Second Edition, Mc Graw Hill Education, ISBN: 0071777148.
 - iii) J Prasad, C G Krishnadas Nair (2007), "Non-Destructive Test and Evaluation of Materials", Mc Graw Hill Education, 2007, ISBN: 0070620849.

2. Cour Name	rse Advance Tribology	L		Т		Р	
3. Course Code		3	0		0		
	of Course (use	Core ()	PE (✔)	OE ()	EAS ()	BSC ()	
5. Pre- requisite (if any)	Basics of Lubrication & Bearing	6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()	
		res, Tutorials, Practi		0		semester)	
Lecture	s = 42	Tutorials = 0	P	ractical =	= 0		
	se Description	·	·				
		lifferent types of wea					
		of target material. It d				earings.	
		udents undergoing this		-			
· .		understanding of the su		•••		5 5	
,		derstand the principles			brication regim	nes, theories of	
		lvanced lubrication tec	_				
		ole of Hydrostatic and	•		• •		
iv) To ur	iderstand the princip	ple and applications of	Elasto-	hydrodyn	amic lubricatio	on.	
10. Cour	se Outcomes (COs): On course completi	on stude	ents will b	e able to		
		tribology for the perfe				c idea on consequence	
		ns, wear theories and a		•	•		
ii) To ur		es of hydrodynamic lub	-	-		ecting the effectivenes	
	pply the knowledge deration of various	e for finding the perf factors.	formanc	e of hydr	ostatic and ga	s lubrication with th	
	nderstand the theo odynamic lubrication	ories of rolling fricti n.	on in 1	rolling el	ements and s	ignificance if Elasto	
11. Unit	wise detailed conte	nt					
Unit-1	Number of	Title of the unit: In	troducti	ion			
	lectures = 11						
temperature a Surface Roug	nd pressure on visc ghness, Friction an		C		·	·	
with criticisn		, classification of we					
Unit – 2	Number of lectures = 11	Title of the unit: Hy	drodyn	amic Bea	nrings		
•	•	ation, fundamentals der bearing, Step bear				0	

condition; load carrying capacity and attitude angle, oil flow, friction in journal bearings; Cavitation, oil whirl in journal bearings and methods of cure; bearing materials

Unit – 3	Number of	Title of the unit: Hydrostatic Bearings
	lectures = 10	

System of hydrostatic lubrication, restrictors, circular step bearings, Rectangular thrust bearings, opposed pad bearings; multi recess journal bearings, hydrostatic lift, hybrid bearings.

Gas Lubricated Bearings

Governing equations, limiting solutions, infinitely long plane slider &journal bearings, externally pressurized gas bearings.

Unit – 4	Number of	Title of the unit: Elasto-hydrodynamic Lubrication & Rolling Element
	lectures = 10	Bearings

Theoretical consideration, Grubin type solution, film-thickness equation, different regimes in EHL contacts, Geometry and kinematics of ball bearings, stress & deformations, load capacity, prediction of fatigue life of ball bearings and lubrication of ball bearings.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Halling J. (1978), "Principles of Tribology", United Kingdom: Macmillan Education UK, ISBN: 9781349041381, 1349041386

Reference Books

- i) Huang, P., Wen, S. (2017), "Principles of Tribology", Germany: Wiley, ISBN: 9781119214915, 1119214912
- ii) Bhushan, B. (2013), "Principles and Applications of Tribology", Germany: Wiley, ISBN: 9781118403013, 1118403010
- iii) Batchelor, A. W., Stachowiak, G. (2013). Engineering Tribology. United Kingdom: Elsevier Science, ISBN: 9780123977762, 0123977762

	Course	Design of	L		Т		Р
	Name	Transmission					
		System					
3.	Course	System	3		0		0
	Code				Ū		U
		urse (use tick	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
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	Pre-	Mechanical	6. Frequency	Even (🗸)	Odd ()	Either	Every
	requisite	Machine Design	(use tick		ouu ()	Sem ()	Sem ()
	(if any)		marks)			Sem ()	Sem ()
		per of Lectures, Tuto	· · · · · ·	l uming 14 we	eks of one	semester)	
	Lectures =		Tutorials = 0	Practi		semester)	
	Course Des		1 ator rais = 0	Tacu	cai – 0		
		tem is most importan	t part of any automot	ive vehicle (Aften transi	nission refers	simply to th
	-	s gears and gear trains					
-		e. But in broad unde		-		-	-
			e				
	-	gearbox, prop shaft					-
	•	tem course, student	e	•			•
	-	s, brakes, cams etc. A					nderstand th
		a transmission system	n and the materials w	hich are used	to make t	hem.	
9.	Learning O	0					
i	i) To under	stand the various eler	nents involved in a tr	ansmission s	vstem.		
-					/~		
i	ii) To desig	n the system based on) =		
	-	n the system based on ice working drawings	input and output par	ameters.		hes and brake	·s.
i	iii) To produ	•	input and output par of the system involv	ameters. ing pulleys, g	ears, clute		
i	iii) To produ	ce working drawings a applications of the	input and output par of the system involv	ameters. ing pulleys, g	ears, clute		
i i	iii) To produiv) Know the methods	ce working drawings a applications of the	input and output par of the system involv various systems, m	ameters. ing pulleys, g aterials used	ears, clutc to make		
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Parallel Helical Gears – Kinematics – Tooth proportions – Force analysis – Stresses in Helical gear – Design of helical gear – Crossed Helical gears – Straight Bevel gears – Kinematics – Force analysis – Stresses in straight bevel gear tooth – Design of bevel gear – Worm gearing – Kinematics – Forces - Friction and Efficiencies – Stresses in worm gear tooth.

Unit – 4	Number of	Title of the unit: Motion control: clutches, brakes and cams
	lectures = 11	

Internal – Expanding Rim clutches and Brakes, External- Contracting Rim clutches and Brakes – Band type Clutches – Core clutches and Brakes – Energy considerations – Temperature rise – Friction materials.

12. Brief Description of self-learning / E-learning component

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The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book:

i) P. Kanniah, 'Design of Transmission Elements', SciTech Pvt. Ltd., 2015, ISBN 978-81-8-963-8733.

Reference Books:

- i) Joseph Edward Shigley and Charles, R. Mischke (2011), Mechanical Engineering Design, 9th Edition, McGraw –Hill International Editions, ISBN: 978-0-071-07783.
- ii) V B Bhandari, "Design of Machine Elements", TMH Publications, Fourth Edition, 2017, ISBN: 9789339221126.

iii) Sundaraja Moorthy T.V. and Shanmugam, 'Machine Design', Nandhini Publications, 2017, Third Edition, ISBN: 8192549364

	-	tment- Mechanical E	0 0			1		
2. Co	urse Name	Plug-in Electric	L]	Г	P		
		Vehicles in Smart Grid						
3. Co	urse Code	Griu	3)		0	
	pe of Course (use	e tick mark)	Core ()	PE (✓)	,	OE ()	0	
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any		systems and	tick marks)	(✔)	Ouu ()	Sem ()	Sem ()	
unj)	Statistics				~~~~ ()	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
7. Tot	al Number of L	ectures, Tutorials, Pi	ractical (assuming 14 wee	ks of one	semester)	I	
Lectur			Tutorials = 0	Practica		-		
8. Co	urse Description							
This co	urse introduces th	e fundamental concep	ots, principles, analysis and	design of	hybrid ar	d electric	vehicles	
The ma	terial for this cou	rse will be prepared i	in such a manner that it wi	ll be usefu	l for post	-graduate	students	
teacher	s, practitioners an	d final year undergrad	luate students.					
9. Lea	arning objectives	5:						
	i) To k	now the Vehicle Elec	trification & Impact of Ch	arging Str	ategies.			
	ii) Und	erstand the influence	of EVs on power system.					
	iii) To k	now about the ICT Se	olutions to Support EV Dep	ployment.				
	iv) Lear	n about the EV Charg	ging Facility Planning					
10. Co	urse Outcomes (COs): On successful	completion of this course,	the studen	t will be a	ble to		
	i) Dese	cribe about vehicle ele	ectrification and impact of	charging s	trategies			
	ii) Dese	cribe the influence of	EVs on power system.		-			
	iii) Dese	cribe the ICT solution	s to support EV deployment	nt.				
	iv) Dese	cribe the EV charging	and facility planning.					
11. Uni	it wise detailed c	ontent						
Unit-1		Number of	Title of the unit: Vehicle	e Electrifi	ication &	Impact o	f	
		lectures = 10	Charging Strategies					
Introdu	ction, Impact of	charging strategies,	EV charging options and	infrastruc	ture, ener	rgy, econo	omic and	
environ	mental considera	tions, Impact of EV c	charging on power grid, ef	fect of EV	charging	on generation	ation and	
load pro	ofile, Smart charg	ging technologies, Imp	pact on investment.					
Unit – 2	2	Number of	Title of the unit: Influer	nce of EV	s On Pow	er Systen	1	
		lectures = 12						
Introdu	ction, identification	on of EV demand, EV	v penetration level for diffe	erent scen	arios, clas	sification	based or	
penetra	tion level, EV im	pacts on system dema	nd: dumb charging, multip	le tariff cl	narging, si	nart charg	ging, case	
studies.								
Unit –	3	Number of	Title of the unit: ICT S	olutions t	o Suppor	t EV Dep	loyment	
		lectures = 10						
Introdu	ction, Architectur	e and model for smart	grid & EV, ICT players in	smart grid	, smart me	tering, inf	ormation	
& con	nmunication mo	dels, functional and	logical models, techno	ology and	l solution	for sm	art grid	
interope	erability, commu	nication technologies.						
Unit –	4	Number of	Title of the unit: EV Ch	arging Fa	acility Pla	nning		
		lectures = 10						
Energy	generation sche	duling, different pow	er sources, fluctuant elec	tricity, ce	ntralized	charging	schemes	
1	alized charging s	chemes energy storag	e integration into Microgri	d. Design	of V2G A	ogregator	r	

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Boo	13. Books Recommended					
Text Books						
i)	SumedhaRajakaruna, FarhadShahnia and Arindam Ghosh, "Plug In Electric Vehicles in Smart Grids-					
	Integration Techniques", Springer Science + Business Media Singapore Pte Ltd., 2015					
Referen	nce Books					
i)	Canbing Li, Yijia Cao, YonghongKuang and Bin Zhou, "Influences of Electric Vehicles on Power					
	System and Key Technologies of Vehicle-to-Grid", Springer-Verlag Berlin Heidelberg, 2016					
ii)	Qiuwei Wu, "GRID INTEGRATION OF ELECTRIC VEHICLES IN OPEN ELECTRICITY					
	MARKETS", John Wiley & Sons, Ltd, 2013.					

Department Electives-VIII

2. Course	Mobile Robots	L		Τ		Р
Name						
3. Course		3		0		0
Code						
4. Type of Cour	rse (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC
						0
5. Pre-	NIL	6. Frequency	Even (🗸)	Odd ()	Either Sem	Every
requisite (if		(use tick			0	Sem
any)		marks)				0
7. Total Numbe	r of Lectures, Tutor	ials, Practical (assu	ming 14 weeks	s of one sen	nester)	
Lectures = 42	2	Tutorials = 0	Practi	cal = 0		
8. Course Descr	ription	I				
This course introdu	ucas the fundamenta	ls of robotics with an	amphasis or	mobile rok	ote which are i	ntagrata
			*			•
	-	al systems functioning			-	
-		ch as locomotion, se	-			
-	-	as coordination of m	-			
-		al and practical expe	rience to stud	ents throug	h lectures and	hands-o
*	eal robots and simula	ition software.				
9. Learning obj			_			
		ling of the fundament	•			
		ling of the fundament	al technologies	in mobile	robot hardware i	ncludin
	n and sensors.					
		ling of mobile robot c	•	-		
		ding of mobile robot	navigation, w	hich includ	es localization,	mappin
and motior	n planning.					
10. Course Outco	omes (COs):					
i) Students w	vill be able to define r	nobile robots and the	ir fundamental	technologie	es.	
ii) Develop a	basic understanding	of mobile robot contr	ol systems.			
iii) Understand	d the localization of I	Robots.				
iv) Understand	d basics of image pro	cessing and its use in	the designing	of mobile r	obots.	
11. Unit wise det	ailed content					
Unit-1	Number of	Title of the unit: I	ntroduction o	f Mobile R	obotics, Mecha	nics an
	lectures = 10	Locomotion				
A brief history of	mobile robotics, app	lications and market.	Recent advan	ces in the r	nobile robotice	for RIG
		vironment) application				
		bile Robot Kinematic				
						nsualli
	- ·	tinematics, motion co			abitact	վոււ
Unit – 2	Number of	Title of the unit:	rerception, r	ODOUCS AI	contectures an	u KOD(
	lectures = 10	Learning				

Sensors Classification, sensor characterization, wheel/motor encoders, heading/orientation sensors, ground based beacons, active ranging, motion/speed sensors, vision based sensors. Low level control, Control architectures, software frameworks, Robot Learning, case studies of learning robots.

Unit – 3	Number of	Title of the unit: Mobile Robot Localization
	lectures = 11	

Introduction, the challenge of localization: Noise and aliasing, to localize or not to localize: localization-based navigation versus programmed solutions, map representation, probabilistic map, map based localization, autonomous map building. Planning and navigation: Planning and reaction, obstacle avoidance, D* algorithm, Navigation architecture, case studies.

Unit – 4	Number of	Title of the Unit: Introduction to image processing
	lectures = 11	
	lectures = 11	

Introduction to computer vision, Image processing: Point operators, Linear Filters, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations. Camera Systems in Machine: Camera Technology, History in Brief, Machine Vision versus closed Circuit Television (CCTV), Sensor Technologies, spatial Differentiation: 1D and 2D, CCD Technology, Full Frame Principle, Frame Transfer Principle, Interline Transfer, Interlaced Scan Interline Transfer, Frame Readout.

12. Brief Description of self-learning / E-learning component

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The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Embedded Robotics: Mobile Robot Design and Applications with Embedded Systems. T. Braunl. Springer-Verlag 2003.

Reference Books

i) Roland Siegwart & Illah R. Nourbakhsh, "Introduction to autonomous mobile robots", Prentice Hall of India, 2004.

ii) George A. Bekey "Autonomous Robots" MIT Press.

iii) Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavrakiand Sebastian Thrun, "Principles of Robot motion: Theory, Algorithm and Implementations", MIT Press.

	-	partment: Mechanical	5					
2. Course	Name	Computational	L	Т	Τ		P	
-		Fluid Dynamics						
3. Course			3	0		0		
• -		(use tick mark)	Core ()	PE (✓)		OE ()		
5. Pre-req	uisite	Fluid Mechanics	6. Frequency	Even	Odd ()	Either	Every	
			(use tick marks)	(✔)		Sem ()	Sem (
		f Lectures, Tutorials,		8		•)		
Lectures = 4			Tutorials = 0	Pra	ctical = 00			
8. Course	Descript	ion:						
 9. Course i) To u trans ii) To s iii) To k iii) To k iv) To a 10. Course i) 	Objectiv nderstan afer. olve one earn mes pply the Outcome	ng equations, meshing i res: d the mathematical bas and two-dimensional p hing methods and intri- various finite difference es (COs): At the end of cnowledge of CFD tech id flow fields using CF	sis and evolution of partial differential e- cacies and techniqu ing schemes to CFI f this course, the lea niques, basic aspec	f the governing quations using es of discretizat D problems. urner will be:	equations of traditional CF tion.	fluid flow D tools.		
	Able to v	uid flow problems and verify the different finite ed content		approach.				
Unit-1	Numb	er of lectures = 11	Title of the un	it: Introductio	n and Gover	ning Equa	tions	
Continuity – conditions - Applications	Momen Classific and rele		eric integral form tial equations – Hy	for governing perbolic - Para	equations - In bolic - Ellipti	nitial and H	Boundar	
Unit - 2	Numb	er of lectures = 10	Title of the un	it: Discretizati	on			
Method– Co equations - U	mpariso Jniform	retization - Discretization n of discretization by and non-uniform grids	he three methods - Numerical errors	- Introduction t - Grid independ	o Finite diffe ence test - O _l	rences - D ptimum ste	ifferenc p size.	
Unit - 3	TNUMD	er of lectures = 10	Title of the un	ni Gria Gene	ration and T	ranstorma	uon	
- Form of the	e governi	nsformation of non-uni ing equations suitable f on -Adaptive grids - Mo	or CFD - Compress	ed grids - Boun	ndary fitted co		-	

Steady one-dimensional, two and three-dimensional conduction - Steady one-dimensional convection and diffusion – Transient one-dimensional and two-dimensional conduction – Explicit - Implicit - Crank-Nicolson - ADI scheme – Stability criterion. Discretization of convection - Diffusion – Central difference, upwind, hybrid and power law schemes - Representation of the pressure - Gradient term and continuity equation – Staggered grid.

12. Brief Description of self-learning / E-learning component

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The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended						
Text Book						
i)	J.D. Anderson, Jr., (2012), Computational Fluid Dynamics - The basics with applications, McGraw-					
	Hill, ISBN: 978-1-259-02596-9.					
Referen	ces Books					
i)	John D. Ramshaw (2011), Elements of Computational Fluid Dynamics, Imperial College Press.					
	ISBN: 978-1-848-16695-0.					
ii)	Oleg Zikanov (2010), Essential Computational Fluid Dynamics, John Wiley & Sons. ISBN: 978-0-					
	470-42329-5.					
iii)	Valter Bruno Reis e Silva João Cardoso (2020), Computational Fluid Dynamics Applied to Waste-					
	to-Energy Processes: A Hands-On Approach, Butterworth-Heinemann Inc, ISBN-13: 978-					
	0128175408.					

1.	Name of the Do	epartment- Mechanical Engi	neering				
2.		Press Tools & Dies	L		Т		Р
3.	Course Code		3	0			0
4.	Type of Course	e (use tick mark)	Core ()	PE OE (✓) ()		EAS ()	BSC ()
5.	Pre-requisite	Manufacturing Processes	6. Frequency	Even	Odd	Either	Every Sem
	(if any)	and Technology	(use tick marks)	(✔)	0	Sem ()	0
7.		of Lectures, Tutorials, Pract					
	Lectures = 42		Tutorials = 0	Pr	actical =	= 0	
	Course Descrip			L			
		subject is designed to acquire	theoretical and pra	ctical kn	owledge	of differen	nt types of
too	ls and dies used i	in manufacturing processes.					
9.	i) To understa	tives: Students undergoing the nd the fundamentals of press v	•		the varie	ous press v	vorking
	-	and machines.					
		nd and compare different type					
		nd the construction and operat	. .	0 0			
	iv) To understa clamping D	and the principles of jigs and evices.	l fixtures design, l	ocating	principle	es, locating	g elements and
10.		nes (COs): On course complet	tion students will b	e able to			
		the various press working and					
	· .	rate the various bending, form	-		s press w	orking one	erations.
		e concepts by considering vari	U U		^	0 1	
	· • • •	d design suitable jigs and fixtu	Ū.	•	Ũ		
11.	Unit wise detai	led content	_				
	nit-1	Number of lectures = 10	Title of the unit:	Press T	ool Desi	gn	
Int	roduction Press	operations – Blanking, piercin	g Fine Blanking 1	Notching	Darfora	ting Trim	ming Shaving
		ibbling, Bending, Drawing, Sc					
		ting Terminology, Working o					
		ombination dies, Progressive of					
stri	p layout, clearan	ce, angular clearance, clearanc	e after considering	elastic r	ecovery,	cutting for	rces, method of
	U U	ces, Die block, die block thickn		•			
		g punches, Strippers. Stoppers	s, Stock stop, Stoc	ck guide,	Knock	outs, Pilot	ts. Blanking &
Pie	rcing die design-	single & progressive dies.					
U	nit – 2	Number of lectures = 11	Title of the unit:	Bending	g, Form	ing and D	rawing Dies
& i	U	Bending Terminology, V – Be annel dies. Design Principles-	0		0		
For	U 1	oduction, Types – solid form d Assembly dies.	ies, pad type form	dies, curl	ing Dies	, Embossir	ng dies, coining
Dra		roduction, Difference between	•	0	0	etal flow d	luring drawing,

Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies, Forging design factors – Draft, fillet & Corner radius, parting line, shrinkage & die wear, mismatch, finish allowances, webs & ribs Preliminary forging operation- fullering, edging, bending, drawing, flattering, blacking finishing, cutoff. Die design for machine forging – determination of stock size in closed & open die forging. Tools for flash trimming & hole piercing, materials & manufacture of forging dies.

Unit – 4 Number of lectures = 11 Title of the unit: Design of Jigs & Fixtures

Introduction, locating & clamping – principle of location, principle of pin location, locating devices, radial or angular location, V –location, bush location design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures.

Drilling Jigs: Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs – Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig. Jig feet.

Milling Fixtures: Essential features of milling fixtures, Milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping devices.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Venkataraman, K. (2015), "Design of Jigs, Fixtures and Press Tools", United Kingdom: Wiley, ISBN: 9781119155676, 1119155673

Reference Books

- i) Boljanovic, V. (2004), "Sheet Metal Forming Processes and Die Design", United States: Industrial Press, ISBN: 9780831131821, 0831131829
- ii) Joshi P.H. (1998), "Jigs and Fixtures", India: Tata McGraw-Hill Education, ISBN: 9780070680739, 0070680736

iii) John G. Nee (2010), "Fundamentals of Tool Design", United States: Society of Manufacturing Engineers, ISBN: 9780872638679, 0872638677

1. Name of the De	partment- Mechanic	al Engineering					
2. Course Name	Finite ElementLT		Р				
	Analysis						
3. Course Code	urse Code 3 0		0				
4. Type of Course	(use tick mark)	Core ()	PE ((√)		OE ()	
5. Pre-requisite	Mechanics,	6. Frequency	Ever	n (🗸)	Odd ()	Either	Every
	Strength of	(use tick marks)				Sem ()	Sem ()
	Materials &						
	Engineering						
	Maths						
7. Total Number	of Lectures, Tutorials	s, Practical (assuming)	14 wee	ks of o	ne semeste	r)	
Lectures = 42		Tutorials = 00		Pract	ical = 00		
8. Course Descrip	tion:						

The finite element analysis (FEA) is among one of the most powerful tools for the numeric solution of wide range of engineering problems. The application ranges from deformation and stress analysis of civil and mechanical structures, automotive components, aircraft designs, heat flux analysis, fluid flow problems, electrical magnetic flux problem. Upon completion, students should be able to solve the problems in solid mechanics and heat transfer using FEA.

9. Learning Objectives:

- i) To enable the students, understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis.
- ii) To understand the process of creating finite elements.
- iii) To develop finite element equations for simple and complex domains.

iv) To familiarize students with variety of problem-solving techniques used in various domains.

10. Course Outcomes (COs):

- i) Will be introduced to the concepts of Mathematical Modeling of Engineering Problems.
- ii) Will get to know various Discretization techniques.
- iii) Will appreciate the use of FEM to a range of Engineering Problems.
- iv) Will learn different problem-solving techniques applied in different situations.

11. Unit wise detailed content

Unit-1	Number of lectures = 11	Title of the unit: Introduction

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

Unit - 2	Number of lectures = 10	Title of the unit: Discretization of the problem				
One Dimens	One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements					
– Derivation	of Shape functions and Stiffness	matrices and force vectors- Assembly of Matrices - Solution of				

problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

Unit - 3	iit - 3 Number of lectures = 09 Title of the unit: FEM Analysis						
cint o							
Second Order 2D Equations involving Scalar Variable Functions - Variational formulation -Finite Element							
formulation - Triangular elements - Shape functions and element matrices and vectors. Application to Field							
Problems – T	Thermal problems – Torsion of No	n circular shafts –Quadrilateral elements – Higher Order Elements.					
		train and axisymmetric problems - Body forces and temperature					
effects - Stre	ess calculations – Plate and shell e	elements.					
Unit - 4	Number of lectures = 12	Title of the unit: FEM problems					
NT - 4	The second secon	-1					
	• •	elements - Shape functions for iso parametric elements -					
	• •	elements – Shape functions for iso parametric elements – ents – Numerical integration and application to plane stress					
One and two	dimensions – Serendipity eleme	* *					
One and two problems – I	o dimensions – Serendipity eleme Matrix solution techniques – Solu	nts – Numerical integration and application to plane stress					
One and two problems – I	o dimensions – Serendipity eleme Matrix solution techniques – Solu	nts – Numerical integration and application to plane stress utions Techniques to Dynamic problems – Introduction to					
One and two problems – I Analysis Sof	o dimensions – Serendipity eleme Matrix solution techniques – Solu	ents – Numerical integration and application to plane stress utions Techniques to Dynamic problems – Introduction to ement analysis applied to various industrial applications.					
One and two problems – I Analysis Sof 12. Brief De	o dimensions – Serendipity eleme Matrix solution techniques – Solu- tware. Current trends in Finite ele scription of self-learning / E-lea	ents – Numerical integration and application to plane stress utions Techniques to Dynamic problems – Introduction to ement analysis applied to various industrial applications.					

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Bo	13. Books Recommended					
Text B	ook					
i)	Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005, ISBN 13: 9780070607415.					
Refere	nce Books					
i)	Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007,					
	ISBN-10: 8120323157.					
ii)	Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of					
	Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002, ISBN-13: 978-0471356059.					
iii)	Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall					
	College Div, 4 th Edition, 2015, ISBN-10: 9332551820.					

	Traine of th	e Depai unent- Mieth	anical Engineering										
<i>—</i> •	Course	Vehicle Body	L	T P		Р							
•	Name	Dynamics											
3.	Course		3	0			0						
	Code												
4.	Type of Co	urse (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()							
5.	Pre-	Engineering	6. Frequency	Even	Odd ()	Either Sem	Every Sem						
j	requisite	Graphics and	(use tick	(✔)		0	0						
	(if any)	Design	marks)										
7.													
Lectures = 42Tutorials = 0Practical = 0													
8.	Course Des	cription											
Vehi	cle body dy	namics is a very impor	tant part of automob	ile field, In t	his course w	e have study a	bout types of						
car b	ody details,	safety features, vehicle	e aerodynamics, abo	ut the drag f	orce, differe	nt types of bus	body details						
and c	commercial	vehicle body.											
9. 1	Learning o	bjectives:											
ij) To make	students familiar with	the vehicle body pa	rameters and	d different ty	pes of car body	у.						
i	i) Students	can understand the vel	hicle aerodynamics.										
i	ii) Students	can learn the objective	e of car speed.										
i	v) Student	can learn the safety me	asures of vehicle bo	dy									
10.	Course Ou	tcomes (COs): On con	npletion of this cours	se, the stude	nts will be al	ble to							
ij) Understa	and the principles of Ve	ehicle Body Dynami	cs									
i	i) Analyze	the dynamics of road v	vehicles.										
		with the terminology of	-	mics, stabili	ty and handli	ng.							
i	v) Know th	e detailing of the Bus l	Body.										
11.	Unit wise d	etailed content	1				11. Unit wise detailed content						
Uni	it-1	Number of	Title of the unit: Car Body Details										
		lectures = 11											
Typ	pes: Saloon,	lectures = 11 Convertibles, Limous	sine, Estate van, rac			bility: regulati	ons, driver's						
• •				ing and spo	rts car. Visi	• •							
visi equ	ibility, test f ipments for	Convertibles, Limous for visibility, Methods car. Car body construct	of improving visibi	ing and spo lity and spa	rts car. Visi ce in cars. S	• •							
visi equ	ibility, test	Convertibles, Limous for visibility, Methods car. Car body construc Number of	of improving visibi	ing and spo lity and spa	rts car. Visi ce in cars. S	• •							
visi equ Uni	ibility, test f ipments for it – 2	Convertibles, Limous for visibility, Methods car. Car body construc Number of lectures = 10	of improving visibi etion. Title of the unit:	ing and spo lity and spa Vehicle Aer	rts car. Visi ce in cars. S odynamics	afety: safety d	esign, safety						
visi equ Uni	ibility, test f ipments for it – 2 jectives, Ve	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, va	of improving visibi ction. Title of the unit: arious types of force	ing and spo lity and spa Vehicle Aer s and mome	rts car. Visi ce in cars. S odynamics nts, Effects c	afety: safety d	esign, safety						
visi equ Uni Obj win	ibility, test for ipments for it - 2 jectives, Ve ad effects on	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments,	of improving visibi etion. Title of the unit: arious types of force various body optim	ing and spo lity and spa Vehicle Aer s and mome ization tech	rts car. Visi ce in cars. S odynamics nts, Effects c niques for m	afety: safety d	esign, safety noments, side Wind tunnel						
visi equ Uni Obj win	ibility, test for ipments for it - 2 jectives, Ve ad effects on	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, va	of improving visibi etion. Title of the unit: arious types of force various body optim	ing and spo lity and spa Vehicle Aer s and mome ization tech	rts car. Visi ce in cars. S odynamics nts, Effects c niques for m	afety: safety d	esign, safety noments, side Wind tunnel						
visi equ Uni Obj win test mon	ibility, test for ipments for it - 2 jectives, Vel ad effects on ting: Flow ments.	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu	of improving visibi etion. Title of the unit: arious types of force various body optimes, scale model tes	ing and spo lity and spa Vehicle Aer s and mome sization tech sting. Comp	rts car. Visi ce in cars. S odynamics nts, Effects c niques for m onent balan	afety: safety d	esign, safety noments, side Wind tunnel						
visi equ Uni Obj win test mon	ibility, test f ipments for it – 2 jectives, Ve nd effects on ting: Flow	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu Number of	of improving visibi etion. Title of the unit: arious types of force various body optim	ing and spo lity and spa Vehicle Aer s and mome sization tech sting. Comp	rts car. Visi ce in cars. S odynamics nts, Effects c niques for m onent balan	afety: safety d	esign, safety noments, side Wind tunnel						
visi equ Uni Obj win test mon Uni	ibility, test for it -2 jectives, Vend effects on ting: Flow ments. it -3	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu Number of lectures = 10	of improving visibi etion. Title of the unit: T arious types of force various body optim es, scale model tes Title of the unit: I	ing and spo lity and spa Vehicle Aer s and mome sization tech sting. Comp Bus Body D	rts car. Visi ce in cars. S odynamics nts, Effects c niques for m onent balan etails	of forces and m ninimum drag. ce to measure	noments, side Wind tunnel e forces and						
visi equ Uni Obj win test mon Uni	ibility, test for it -2 jectives, Vend effects on ting: Flow ments. it -3	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu Number of lectures = 10 s, single decker, doub	of improving visibi etion. Title of the unit: arious types of force various body optim es, scale model tes Title of the unit: I le decker, two level,	ing and spo lity and spa Vehicle Aer s and mome sization tech sting. Comp Bus Body D split level a	rts car. Visi ce in cars. S odynamics nts, Effects of niques for monent balan etails	afety: safety d of forces and m ninimum drag. ce to measure ed bus. Bus Bo	oments, side Wind tunnel e forces and						
visi equ Uni Obj win test mod Uni Typ Flo	ibility, test for ipments for it - 2 jectives, Vender a effects on ting: Flow ments. it - 3 pes, mini but or height, e	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu Number of lectures = 10 s, single decker, doubt	of improving visibi- ction. Title of the unit: T arious types of force various body optimes, scale model tes Title of the unit: I le decker, two level, ce and exit location,	ing and spo lity and spa Vehicle Aer s and mome dization tech sting. Comp Bus Body D split level a seating din	rts car. Visi ce in cars. S odynamics nts, Effects of niques for m onent balan etails and articulate nensions. Co	of forces and m ninimum drag. ce to measure ed bus. Bus Bo	oments, side Wind tunnel ody Lay Out: etails: Frame						
visi equ Uni Obj win test mod Uni Typ Flo	ibility, test for ipments for it - 2 jectives, Vender a effects on ting: Flow ments. it - 3 pes, mini but or height, e	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu Number of lectures = 10 s, single decker, doub	of improving visibi- ction. Title of the unit: T arious types of force various body optimes, scale model tes Title of the unit: I le decker, two level, ce and exit location,	ing and spo lity and spa Vehicle Aer s and mome dization tech sting. Comp Bus Body D split level a seating din	rts car. Visi ce in cars. S odynamics nts, Effects of niques for m onent balan etails and articulate nensions. Co	of forces and m ninimum drag. ce to measure ed bus. Bus Bo	oments, side Wind tunnel ody Lay Out: etails: Frame						
visi equ Uni Obj win test mon Uni Typ Flo con typ	ibility, test f ipments for it - 2 jectives, Vend effects on ting: Flow ments. it - 3 pes, mini but or height, enstruction, D e construction	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu Number of lectures = 10 is, single decker, double ngine location, entrance ouble skin construction on.	of improving visibi- ction. Title of the unit: T arious types of force various body optimes, scale model tes Title of the unit: I le decker, two level, ce and exit location, on- Types of metal s	ing and spo lity and spa Vehicle Aer s and mome sization tech sting. Comp Bus Body D split level a seating dim section used	rts car. Visi ce in cars. S odynamics nts, Effects of niques for monent balan etails and articulate nensions. Co -Regulations	afety: safety d of forces and m ninimum drag. ce to measure ed bus. Bus Bo onstructional de -Conventional	oments, side Wind tunnel ody Lay Out: etails: Frame						
visi equ Uni Obj win test mon Uni Typ Flo con typ	ibility, test f ipments for it - 2 jectives, Vend effects on ting: Flow ments. it - 3 pes, mini but or height, en struction, D	Convertibles, Limous for visibility, Methods car. Car body construct Number of lectures = 10 hicle drag and types, van forces and moments, visualization techniqu Number of lectures = 10 s, single decker, doubt ngine location, entrance Double skin construction	of improving visibi- ction. Title of the unit: T arious types of force various body optimes, scale model tes Title of the unit: I le decker, two level, ce and exit location,	ing and spo lity and spa Vehicle Aer s and mome sization tech sting. Comp Bus Body D split level a seating dim section used	rts car. Visi ce in cars. S odynamics nts, Effects of niques for monent balan etails and articulate nensions. Co -Regulations	afety: safety d of forces and m ninimum drag. ce to measure ed bus. Bus Bo onstructional de -Conventional	oments, side Wind tunnel ody Lay Out: etails: Frame						

Types of body, Flat platform, drop side, fixed side, tipper body, tanker body. Light commercial vehicle body types, Dimensions of driver's seat in relation to controls, driver's cabin design. Body Materials, Trim and Mechanism: Steel sheet, timber, plastics, GRP, properties of materials-Corrosion anticorrosion methods, escalation of paint and painting process, body trim items. Body mechanisms.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. B	13. Books Recommended					
Text B	sook:					
i)	Thomas D.Gillespie, Vehicle body dynamics, SAE International (15 February 1992), ISBN-10					
	: 1560911999.					
Refere	ence Books:					
i)	Powloski. J. Vehicle Body Engineering					
ii)	Massimo Guiggiani, The Science of Vehicle Dynamics, ISBN-10: 9401785325, Springer Nature (22					
	January 2014)					

iii) Giles. J.C., Body Construction and Design

2. Course Name	MEMS & Micro- Systems	L	Т		Р	
3. Course Code		3	0			0
4. Type of Course (use tick mark) Core () PE (✓) EAS () BS						
5. Pre-requisite (if any)	Mechatronics Systems and Its Applications	6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of I	Lectures, Tutorials, P	ractical (assuming 14 v	veeks of on	e semest	ter)	
Lectures = 42		Tutorials = 0	Practical	l = 0		
8. Course Description	n	1	1			
ii) To educate on tiii) To introduce th	es: wledge of semiconduc he rudiments of Micro e working principle of	etors and solid mechanics fabrication techniques. Sensors and Actuators.	to fabricat	e MEMS	S devices	
10. Course Outcomesi) Know the basicii) Understand the	concepts of MEMS sta fundamentals on solvi	ructures under different 1 ng the problem based or	n MEMS str		and charac	teristics
-		f MEMS design and open EMS sensors and actuate		ral annli	cations	
11. Unit wise detailed	0 1		<u></u>	un uppn		
Unit-1	Number of lectures = 10	Title of the unit: Basi	cs of MEM	IS & Int	roductior	l
		omains and Transducers rocesses – New Material		nd Actua	tors – Intro	oduction
Unit - 2 Number of lectures = 10 Title of the unit: Reactor Materials, Reprocessing						
Unit – 2						
	d Mechanical concepts	s in MEMS – Semicondu	uctor device	es – Stree	ss and stra	in

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples

Unit – 4	Number of	Title of the unit: Sensors and Actuators-II
	lectures = 11	The of the unit bendors the field to be
	lectures = 11	

Piezo Resistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.

Reference Books

i) Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.

ii) Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2001.

iii) James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005

iv) Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

1.	Name of the Depart	unent- mechanicai E	Angineer ing					
2.	Course Name	EV Charging	L]	Г	Р		
		Infrastructure						
2	Course Code	Technology	3	(<u> </u>		0	
<u>3.</u>		a diale marile)	S Core ()	PE (✓))	OE ()	U	
4 .	Type of Course (use	Introduction to		. ,	Odd ()		Ename	
5.	Pre-requisite (if	Electric and	6. Frequency (use	Even (✓)	Odd ()	Either Sem ()	Every Sem ()	
	any)	Hybrid Vehicle	tick marks)	(•)		Selli ()	Sem ()	
7.	Total Number of L	•	ractical (assuming 14 wee	ks of one	semester)		
	ctures = 42	,,,,,,,,,,	Tutorials = 0	Practica		,		
8.	Course Description							
	-							
		-	ots, principles, analysis and	-	-			
			in such a manner that it wi	ll be usefi	ul for post	graduate	students	
	-	d final year undergrad	duate students.					
9.	Learning objectives							
		-	meters for better performan	nce.				
		erstand the EV chargi						
	,	m about the Batteries						
			ture of Charging stations of					
10.			completion of this course,	the studen	t will be a	ble to		
			al parameters of batteries.					
		-	ous types of batteries used t	for EV app	plications.			
		elop battery charger f						
	iv) Dev	elop and Design the C	Charging Infrastructure.					
11.	. Unit wise detailed o	content						
Un	it-1	Number of	Title of the unit: Battery parameters					
		lectures = 10						
Ce	ll and battery voltage	es, Charge (or Amph	nour) capacity, Energy sto	ored, Ener	gy densit	y, Specifi	ic power	
An	nphour (or charge) effi	iciency, Energy efficie	ency, Self-discharge rates,	Battery ge	ometry, E	lattery ten	nperature	
	°	ls, Battery life and nur	mber of deep cycles.					
Un	it – 2	Number of	Title of the unit: EV Ch	arging				
		lectures = 12						
Ba	attery Chargers: Char	rge equalization, Con	ductive (Basic charger ci	ircuits, M	icroproce	ssor based	d charge	
cire	cuit. Arrangement of	an off-board condu	ctive charger, Standard J	power lev	els of co	nductive	chargers	
Ind	luctive (Principle of	inductive charging, S	oft-switching power conv	verter for	inductive	charging)	, Batter	
ind	ication methods.							
Un	it – 3	Number of	Title of the unit: EV Ba	tteries				
		lectures = 12						
ma		•	s, Special characteristics of kel-based Batteries Introd			•		
So	dium, Lithium and M		Sodium-based Batteries In nium Batteries Introduction			.		

Unit – 4	Number of	Title of the unit: Charging Infrastructure				
	lectures = 8					
Domestic Chargin	g Infrastructure, Public	Charging Infrastructure, Normal Charging Station, Occasional				
Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.						
12. Brief Descripti	on of self-learning / E-learning	arning component				
The students will be	e encouraged to learn using	g the SGT E- Learning portal and choose the relevant lectures				
delivered by subject	t experts of SGT Universit	y.				
The link to the E-Le	The link to the E-Learning portal. http://sgtlms.org					
Journal papers; Pate	ents in the respective field.					
13. Books Recomm	nended					
Text Books						
iv)	Iqbal Hussein, Electric an	nd Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.				
v)	C.C Chan, K.T Chau: Me	odern Electric Vehicle Technology, Oxford University Press Inc.,				
	New York 2001.					
Reference Books						
v)	Mehrdad Ehsani, Yimi G	ao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric				
	and Fuel Cell Vehicles: F	Fundamentals, Theory and Design, CRC Press, 2004.				
vi)	James Larminie, John Lo	wry, Electric Vehicle Technology Explained, Wiley, 2003.				

1.	1. Name of the Department- Mechanical Engineering						
2.	Course	Heat and	d Mass	L		Т	Р
	Name	Transfer					
		Laborato	ory				
3.	Course			0		0	2
	Code						
4.	4. Type of Course (use tick			Core	(✔)	PE ()	OE ()
	mark)						
5.	Pre-	Enginee	ring	6. Freq	uency	Even (🗸)	Odd ()
	requisite (if	Thermo	dynam	(use	tick		
	any)	ics	-	marl	ks)		
	•						
7.	7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
	Lectures =0 Tutoria		als = 0 Pract		tical = 28		
8.	Course Desci	ription					

An introductory course in heat and mass transfer covering conduction, convection and radiation heat transfer, principles of heat exchanger and mass transfer. Heat transfer and mass transfer are kinetic processes that may occur and be studied separately or jointly. Studying them apart is simpler, but both processes are modeled by similar mathematical equations in the case of diffusion and convection (there is no mass-transfer similarity to heat radiation), and it is thus more efficient to consider them jointly

9. Learning Objectives:

- i) To comprehend and evaluate various modes of heat and mass transfer.
- ii) To design fin enhanced systems, evaporators, condensers and heat exchangers.
- iii) To understand boundary layer theory, condensation and boiling.
- iv) To determine effectiveness of heat exchangers using LMTD and NTU.

10. Course Outcomes (COs): On completion of this course, the student will be able to:

- i) Apply basic principles of fluid mechanics, thermodynamics, heat transfer for designing heat and mass transfer systems.
- ii) Model heat, mass and momentum transport systems and develop predictive correlation.
- iii) Assess and evaluate various designs for heat and mass transfer and optimize the solution.
- iv) Apply the basic principles of heat exchanger applications.

11. Lab Content						
Sr.	Title	COs Covered				
No.						
1	To calculate thermal conductivity of insulating	i), ii)				
	material in the form of slab.					
2	To calculate total thermal resistance and thermal	ii), iii)				
	conductivity of composite wall.					
3	To calculate the thermal conductivity of	ii), iv)				
	insulating powder.					

4	To calculate the thermal conductivity of given	ii), i)
	liquid (glycerin).	11), 1)
5	To calculate the average heat transfer co-	ii), iii)
Ũ	efficient of vertical cylinder under natural	,
	convection.	
6	To calculate surface heat transfer coefficient for	ii)
0	a pipe by forced convection and compare heat	,
	transfer coefficient for different air flow rates	
	and heat flow rates.	
7	To calculate the heat transfer coefficient	ii)
	experimentally and theoretically for free and	
	forced convection and compare the theoretical	
	temperature distribution with experimentally	
	obtained distribution.	
8	To study the Boiling Heat Transfer phenomenon	ii)
	for pool boiling of water.	
9	To conduct test on a heat pipe and compare the	i), ii)
	temperature distribution and rate of heat transfer	
	with geometrically similar copper and stainless-	
	steel tubes.	
10	To determine the value of Stefan-Boltzmann	i), ii)
	constant for radiation heat transfer.	
11	To measure the property of emissivity of the test	ii)
	plate surface at various temperatures.	
12	To study and compare temperature distribution,	ii), iv)
	heat transfer rate, overall heat transfers co-	
	efficient in parallel flow and counter flow heat-	
	exchanger.	

1.	1. Name of the Department- Mechanical Engineering						
2.	Course Name	Dynamics of	L	Т		Р	
		Machines Lab					
3.	Course Code		0	0		2	
4.	Type of Course (us	e tick mark)	Core (✓)	PE ()		OE ()	
5.	Pre-requisite (if	Kinematics of	6. Frequency (use	Even	Odd ()	Either	Every
	any)	Machines	tick marks)	(✔)		Sem ()	Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Le	ctures = 0		Tutorials = 0	Practica	l = 28		

8. Brief Syllabus

Dynamic loads and undesired oscillations increase with higher speed of machines. At the same time, industrial safety standards require better vibration reduction. This course covers parameter identification, balancing of mechanisms, torsional and bending vibrations, vibration isolation, and the dynamic behavior of drives and machine frames as complex systems. Typical dynamic effects, such as the gyroscopic effect, damping and absorption, shocks, nonlinear and self-excited vibrations are covered in dynamics of machinery. Upon completion, students should be able to analyze the effect of dynamic forces on systems and try to minimize the negative impact of such effects.

9. Learning objectives:

- i) To understand the concepts of turning moment diagrams, flywheel design and the dynamics of reciprocating engines.
- ii) To understand the balancing procedures for rotating and reciprocating masses, rotors and engines.
- iii) To understand the fundamentals of free and forced vibrations.
- iv) To understand the mechanisms for control.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Demonstrate skills to design flywheel for an IC engine and punching press with the consideration of geometrical and economical constraints.
- ii) Perform static and dynamic balancing of high-speed rotary and reciprocating machines.
- iii) Analyze free and forced vibrations of machines, engines and structures.
- iv) Apply the concept of governors for speed control.

11. Lab Component

Sr. No.	Title	COs covered
1	To determine the Moment of Inertia of Flywheel.	i)
2	Comparative study of static and dynamic balancing in rotors.	ii)
3	To determine natural frequency of longitudinal vibration in spring mass system.	iii)
4	Determination of torsional frequency of a single rotor system.	iii)
5	To determine the frequency of undamped free vibration of an equivalent spring	iii)
	mass system.	
6	To determine the radius of gyration 'k' of the given compound pendulum.	iii)
7	To find out critical speed and to compare the whirling speed of a shaft.	iii)
8	To study TRI –FILAR / BI-FILAR System.	iii)
9	To perform experiment on Proell governor to determine performance	iv)
	characteristic curves, and to find stability & sensitivity.	
10	To perform experiment on Hartnell governor to determine performance	iv)
	characteristic curves, and to find stability & sensitivity.	
11	To determine gyroscopic couple on motorized gyroscope.	iv)

12	To perform experiment on Watt and Porter governors to determine performance	iv)
	characteristic curves, and to find stability & sensitivity.	

Department Electives-VII Lab

	Course Name	Pneumatics & Control Lab	L		Τ		Р	
	Course		0		0		2	
	Code				v			
4. T	Type of Cour	se (use tick mark)	Core ()	PE (✓)	OE () I	EAS ()	BSC ()	
r	Pre- equisite (if ny)	NIL	6. Frequency (use tick marks)	Even (✓)	Odd () I	Either Sem	Every Sem ()	
7. T	otal Numbe	r of Lectures, Tutor	ials, Practical (assur	ning 14 weeks	of one semeste	er)		
L	ectures = 0		Tutorials = 0	Practio	cal = 28			
8. C	Course Descr	ription		•				
9. L i) ii) iii iii 10. C i) ii) iii	 Learning obj To learn th To be able To present control me To underst Course Outco Design an Visualize I The labs g systems, present 	ectives: e basic principles of to design a Pneumat an overview of robot chanisms etc. and the various Robo omes (COs): appropriate pneumation now a pneumatic circ give students an edu rogramming, signal p	ic circuit for a specific ics in practice and res of configurations. Ic circuit for a given a uit will work to accon cation that go well b rocessing, interfacing	ed problem at h earch with top pplication. pplish the func beyond robotic , and electronic	nand. ics including vis tion. s into fields lil cs	sion, motion		
iv	. –		e configuration and ic			of Robot.		
11. L	ab Compon	ent						
a	o. Title					CO	s covere	
Sr. No								
	To dem	onstrate the motion of	of a single acting cylir	ider and double	e acting cylinde		i), ii)	
1	To perf		of a single acting cylir ic for forward stroke o			er.		
1 2	To perf two ma To perf	form AND & OR log nual controls.	-cycle operation of a	of a double act	ing cylinder usi	er. ng	i), ii)	
1 2 3	To perf two ma To perf lever va	form AND & OR log nual controls. form single and multi alve and memory val feedback control, mal	-cycle operation of a	of a double act	ing cylinder using cylinder using read	er. ng oller	i), ii) i), ii)	
Sr. No 1 2 3 4 5	To perf two ma To perf lever va Using f trajecto Find a	form AND & OR log nual controls. form single and multi alve and memory val feedback control, mal	-cycle operation of a ove. ke a marker that is atta	of a double act double acting c ached to a robo	ylinder using root to follow a	er. ng oller	i), ii) i), ii) i), ii)	

2. Course	Power Plant	L	Т	Р
Name	Engineering Lab			
3. Course		0	0	2
Code				
4. Type of C	Course (use tick mark)	Core ()	PE (✔)	OE ()
5. Pre-	Engineering	6. Frequency	Even $Odd(\checkmark)$	Either Every
requisite	Thermodynamics	(use tick marks)	0	Sem Sem (
7 T-4-1 N				0
7. Total Nul Lectures	mber of Lectures, Tutoria – 0	Tutorial	8	
8. Course D		Tutorial	s = 0 Fractical =	- 20
	igineering course is concern	ned with the types co	Instruction working prin	ciples and performan
	ventional and non-conver	• •	• 1	
	performance of various con			-
-	o focusses on various sub		•	
ooling towers	, fuel and air handling system	m, super-heaters, inter	r-coolers, re-heaters and	waste handling system
o have a prope	r understanding. This cours	e also discusses the S	team power plant in deta	il as 60% of total energ
produced in wo	orld are generated by therma	al power plants. The s	yllabus also covers nucle	ear power plant in deta
which is a need	l of current scenario.			
. Learning	•			
	ch students about the working			
	oduce students to steam ge		and firing methods in o	rder to make the fulle
	thermal power potentialities	•	1 / 1 * 1	
	ble students, understand in ble students, understand in			
	power generation.	detail about liyulo a	nu uleser power plants v	vinen play an importa
	utcomes (COs): On comple	tion of this course th	e students will be able to	
	stand basic power generatio			,
	about the kind of boilers be			ability.
	problems related to gas turb	•	**	
	guish between various pow	•		neets desired econom
	nmental and social requiren	-		
11. Lab Cont	ent			
Sr. No.	Title			COs
				covered
1	To study of modern ste	am power plant.		i)
2	To Study about the Van	rious Types of Fuel &	Ash Handling Systems.	i)
3	To study about differen	nt types of dust collec	tors and pulverized fuel	burners. i)
4	To study about nuclear	power plant.		i)
5	To study of different ty	pes of steam turbines		i), iii)
-				,, ,
6	To study about differen	nt types of condensers		i), ii), iii

8	To study of gas power plant.	iii)
9	To study of combined steam & gas turbine power plant.	iii)
10	Testing of diesel fired water tube boiler-based steam power plant.	ii)

1.	Name of the	Department- Mecha	anica	l Engineering				
2.	Course	Non-Destructive		L		Т	Р	
	Name	Evaluation and						
		Testing Lab						
3.	Course Code			0		0	2	
4.	Type of Cou mark)	rse (use tick		Core ()	PE (✓)	OE ()	Specialization ()
5.	Pre- requisite (if any)		6.	Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Numb	er of Lectures, Tuto	orials	s, Practical (ass	uming 12 we	eks of one s	emester)	

••	Total Humber of Deetares, Fak	filling I I decieul (usse	
	Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

This course provides students a synopsis of non-destructive evaluation and testing methods used in evaluation of welds. This includes understanding the basic principles of various NDT methods with importance, applications and limitations.

9. Learning objectives:

- i) To learn the use of non-destructive examination of welding defects.
- ii) To understand the various inspection methods for non-destructive evaluation.
- iii) To understand the use of thermography in the non-destructive testing.
- iv) To understand the use of radiography in the non-destructive testing.

10. Course Outcomes (COs): On course completion Students will be able to:

- i) Identify the types of equipment used for each Non-Destructive evaluation and testing
- ii) Check different metals and alloys by visual inspection method.
- iii) Explain and perform non-destructive tests like: Liquid penetrant test, Magnetic particle test, Ultrasonic test.
- iv) X-ray and Gamma ray radiography, Leak Test, Eddy current test and Identify defects by using relevant NDT methods.

11. Lab Content							
Sr. No.	Title	COs covered					
1	Dye penetration inspection	ii), iii)					
2	Eddy current testing	i), iv)					
3	Magnetic particle inspection	i), iii)					
4	Ultra-sonic testing (Acoustic resonance technology)	i), iii)					
5	Visual inspection	i), ii)					
6	Electromagnetic testing	i), iii)					

7	Magnetic Flux Leakage testing	i), iii)
8	Infra-red and Thermal Testing	i), iii)
9	LASER testing	i), iii)
10	Scanning electron Microscopy	i), iv),
11	X-ray Diffraction testing	i), iv)
12	Transmission Electron Microscopy	i), iv)

2.	Course	Advance	L		Т		Р
	Name	Tribology Lab					
3.	Course Code		0		0		2
4.	Type of C tick mark		Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5.	Pre- requisite (if any)	Fluid Mechanics	6. Frequency (use tick marks)	Even (🗸)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Nur	nber of Lectu	res, Tutorials, Pi	ractical (assu	uming 14 we	eeks of one semes	ter)
Le	ctures = 0		Tutorials = 0	Practical =	= 28		
8.	Course D	escription	I	1			
lea: <u>knc</u> 9.	 rn about coinception wiedge about coinception iii) To undeption iii) To expanding iii) To expanding iii) To expanding iii) To ana iv) To undeption iii) To ana application iii) To ana application iii) To per lubrication 	nsequences of out different b objectives: Se derstand the fu- pose the studer ations. alyze the perfor derstand the the utcomes (CO obly concepts of e motion. alyze the requi- ation. form tests in of ation. derstand the mos.	wear, wear mecha earing materials. undents undergoing indamentals of tril nts to the factors in prmance characterine eories/laws of slid s): On course com f tribology for the irements and design order to find the factors	anisms, wear g this course bology and as nfluencing th istics of hydr ding and rolli ppletion stude performance gn hydrodyna	theories and are expected ssociated par- e selection of odynamic jo <u>ng friction a</u> ents will be a e analysis and mic journal	analysis of wear p to: rameters. of bearing material urnal bearing. <u>nd the effect of vis</u> ble to: d design of compo and plane slider be ilm thickness in hy	nents experiencing earings for a given
	No.	Title					COs covered
	1	of Pressure hydrodynam the real tin	and Temperatic journal bearing	ure distribut s at different ed through	tion in the loads and sp data acquis	the measurement e fluid film of peeds. To analyze ition system for	i), ii)

2	To perform experiment on the journal bearing test rig for investigating the fluid film thickness of hydrodynamic journal bearings at different loads and speeds. To analyze the real time results obtained through data acquisition system for predicting the performance characteristics of bearing.	i), iii)
3	To measure the frictional torque in hydrodynamic journal bearings at different loads and speeds on journal bearing test rig. To analyze the real time results obtained through data acquisition system for predicting the performance of bearing.	i), iii)
4	To determine wear preventive (WP) and extreme pressure (EP) behavior of lubricants on four ball tester and to measure viscosity of lubricants with the help of viscometer. To analyze the real time results obtained through data acquisition system for predicting behavior of lubricants.	i), iv)
5	To determine the friction and wear characteristics in sliding contacts under various normal loads and speeds on wear and friction monitor. To analyze the real time results obtained through data acquisition system for predicting tribological characteristics.	ii), iv)
6	The modeling and analysis hydrodynamic/hydrostatic bearings using software (ARMD).	ii), iv)

2. Cou	rse Design of	L		Т		Р
Nan	ne Transmission					
	Systems Lab					
3. Cou	rse	0		0		2
Cod						
4. Typ mar	e of Course (use tick k)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5. Pre-	<i>,</i>	6. Frequency	Even (🗸)	Odd ()	Either	Every
requ	isite Machine Design				Sem	Sem
(if a	ny)	marks)			0	0
7. Tota	al Number of Lectures, T	utorials, Practical (ass	uming 14 we	eks of one	semester)	
Lect	tures = 0	Tutorials = 0	Practi	cal = 28		
8. Cou	rse Description					
Гransmis	sion system is most import	ant part of any automore	tive vehicle. (Often transn	nission refers si	imply to the
gearbox t	hat uses gears and gear trai	ins to provide speed and	d torque conv	ersions from	n a rotating po	wer source
to anothe	r device. But in broad unde	erstanding transmission	also refers to	refers to th	e whole drive t	rain,
-	clutch, gearbox, prop shaf					-
	ion system course, student		•		e	
-	clutches, brakes, cams etc.					stand the
0	pects of a transmission sys	tem and the materials w	which are used	l to make th	em.	
	rning Objectives:					
	o understand the various e			ystem.		
	o design the system based					
	o produce working drawin					~
	To Know the applications on the other of the other of the other of the other of the other	of the various systems,	, materials us	ed to make	Transmission	System, an
	rse Outcomes (COs): On	course completion stud	ents will be a	ble to		
	Design pulleys, chain drives	-				
	Determine performance req	•		rcially avail	able transmissi	on drives.
	Design Brakes and Clutches			j		
	Design various types of gea					
	Content					
Sr. No.	Title				COc	overed
1	Study on Gear Box					iv)
2	Study of manual steering	Mechanism				iv)
3	Study of power steering					iv)
4	Study of suspension Syst					i)
5	Study of braking system.					ii), iii)
5				-		
6	Study of clutches (Centri		-	onical).		iii)
6 7	Study on Differential Ge		-	onical).		ii)
6		ar Mechanism of Rear	-	onical).		,

2.	Course Nan		Plug-in Electric Vehicles in Smart Grid Lab	L		Г		P
3.	Course Cod	-		0		0	2	
4.	Type of Cou	ırse (use		Core ()	PE (✓)	1	OE ()	1
5.	Pre-requisit	e (if	Manufacturing	6. Frequency (use	Even	Odd ()	Either	Every
	any)		systems and Statistics	tick marks)	(•		Sem ()	Sem (
7.	Total Numb	er of Le	ectures, Tutorials, P	ractical (assuming 14 we	eks of one	semester)	
Le	ctures = 0		, ,	Tutorials = 0	Practica		/	
8.	Course Des	cription						
Th	is course intro	duces th	e fundamental conce	pts, principles, analysis ar	d design of	f hybrid ar	nd electric	vehicle
Th	e material for	this cou	rse will be prepared i	in such a manner that it w	vill be usef	ul for post	graduate	student
			d final year undergrad			-		
9.	Learning of	ojectives	:					
	i)	To k	now the Vehicle Elec	ctrification & Impact of C	harging Str	ategies.		
	ii)	Und	erstand the influence	of EVs on power system.				
	iii)	To k	now about the ICT Se	olutions to Support EV D	eployment.			
	iv)	Loor			• •			
		LEai	n about the EV Charg	ging Facility Planning				
10	,			ging Facility Planning completion of this course	the studer	t will be a	able to	
10	. Course Out	comes (COs): On successful	completion of this course			ible to	
10	. Course Out i)	comes (Desc	COs): On successful cribe about vehicle ele	completion of this course ectrification and impact o			ible to	
10	Course Out i) ii)	comes (Desc Desc	COs): On successful cribe about vehicle electric the influence of	completion of this course ectrification and impact of EVs on power system.	f charging s		ible to	
10	Course Out i) ii) iii)	comes (Desc Desc Desc	COs): On successful cribe about vehicle elective cribe the influence of cribe the ICT solution	completion of this course ectrification and impact of EVs on power system. Is to support EV deployme	f charging s		ible to	
	Course Out i) ii) iii) iii) iv)	comes (Desc Desc Desc Desc	COs): On successful cribe about vehicle elective cribe the influence of cribe the ICT solution	completion of this course ectrification and impact of EVs on power system.	f charging s		ible to	
11.	. Course Out i) ii) iii) iii) iv) . Lab Conten	comes (Desc Desc Desc Desc t	COs): On successful cribe about vehicle elective cribe the influence of cribe the ICT solution	completion of this course ectrification and impact of EVs on power system. Is to support EV deployme	f charging s			<u> </u>
11	Course Out i) ii) iii) iii) iv)	comes (Desc Desc Desc Desc	COs): On successful cribe about vehicle elective cribe the influence of cribe the ICT solution	completion of this course ectrification and impact of EVs on power system. Is to support EV deployme	f charging s		CO	s ered
11	. Course Out i) ii) iii) iii) iv) . Lab Conten	comes (Desc Desc Desc t Title	COs): On successful cribe about vehicle electribe the influence of cribe the ICT solution cribe the EV charging	completion of this course ectrification and impact of EVs on power system. Is to support EV deployment and facility planning.	f charging s		CO	ered
11	. Course Out i) ii) iii) iii) iv) . Lab Conten	comes (Desc Desc Desc t Title	COs): On successful cribe about vehicle electribe the influence of cribe the ICT solution cribe the EV charging	completion of this course ectrification and impact of EVs on power system. Is to support EV deployme	f charging s		CO	
11	. Course Out i) ii) iii) iii) iv) . Lab Conten	comes (Desc Desc Desc t Title	COs): On successful cribe about vehicle electribe the influence of cribe the ICT solution cribe the EV charging	completion of this course ectrification and impact of EVs on power system. Is to support EV deployme and facility planning.	f charging s		CO	ered
11	Course Out i) ii) iii) iv) Lab Conten No.	comes (Desc Desc Desc t Title To stud	COs): On successful cribe about vehicle electrice the influence of cribe the ICT solution cribe the EV charging	completion of this course ectrification and impact of EVs on power system. as to support EV deployments and facility planning. wehicle charging system. y regulation of EVs.	f charging s		CO	ered i)
11	Course Out i) ii) iii) iv) Lab Conten No. 1 2	comes (Desc Desc Desc t Title To stuc To stuc	COs): On successful cribe about vehicle electribe the influence of cribe the ICT solution cribe the EV charging dy about the Electric	completion of this course ectrification and impact of EVs on power system. is to support EV deployme and facility planning. vehicle charging system. y regulation of EVs. ion of EVs.	f charging s		CO	ered i) i)
11	. Course Out i) ii) iii) iv) . Lab Conten . No. 1 2 3	comes (Desc Desc Desc t To stuc To stuc To stuc To stuc	COs): On successful cribe about vehicle electrice the influence of cribe the ICT solution cribe the EV charging ly about the Electrice ly about the frequenc ly the voltage regulat ly about the smart gri	completion of this course ectrification and impact of EVs on power system. is to support EV deployme and facility planning. vehicle charging system. y regulation of EVs. ion of EVs.	f charging s		CO	ered i) i) i)
11	. Course Out i) ii) iii) iv) . Lab Conten . No. 1 2 3 4	comes (Desc Desc Desc t To stuc To stuc To stuc To stuc	COs): On successful cribe about vehicle electrice the influence of cribe the ICT solution cribe the EV charging dy about the Electrice dy about the frequenc dy the voltage regulat dy about the smart gri dy about the Smart ch	completion of this course ectrification and impact of EVs on power system. Its to support EV deployments and facility planning. wehicle charging system. Ty regulation of EVs. ion of EVs.	f charging s	strategies	CO	i) i) i) ii) iii)
11	. Course Out i) ii) iii) iii) iv) . Lab Conten . No. 1 2 3 4 5	comes (Desc Desc Desc t Totle To stuc To stuc To stuc To stuc	COs): On successful cribe about vehicle electrice the influence of cribe the ICT solution cribe the EV charging dy about the Electrice dy about the frequence dy the voltage regulat dy about the smart gri dy about the Smart ch dy about the Penetrati	completion of this course ectrification and impact of EVs on power system. is to support EV deployme and facility planning. vehicle charging system. y regulation of EVs. ion of EVs. d system of EVs	f charging s	strategies	CO	ered i) i) i) ii) ii)

Department Electives-VIII Lab

1. Name of	the Department- Mecha	nical Engineering				
2. Course	Mobile Robots	Mobile RobotsLTLab		Т		Р
Name	Lab					
3. Course		0		0		2
Code						
4. Type of	Course (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5. Pre-	NIL	6. Frequency	Even (✓)	Odd ()	Either	Every
requisit	e (if	(use tick			Sem ()	Sem ()
any)		marks)				
			· 14 1	C		
7. Total Ni Lecture	umber of Lectures, Tuto	Tutorials = 0			mester)	
		1 utorials = 0	Practi	cal = 28		
8. Course	1		1 . 11	6.1		
	nt to provide drill practice	**		0	-	
	cal thinking in some diffic	-		-		
-	lobile robots. Different as	•	like Hardware	e, software	, sensors use	d, navigation,
	re taught through a practic	al approach.				
9. Learnin	g objectives:					
i) Dem	onstrate a basic understand	ding of the wireless co	ommunication	technologi	es for mobil	e robots.
ii) Desig	gn and implement mobile	robot functions using	the iRobot pla	tform and	its program	development
tool.						
	gn, develop, debug and do					
	he basic skills required to	conduct research in a	n engineering a	area.		
	Outcomes (COs):					
	ents will start analyzing, c		-	navigation	n systems fo	r applications
	pan multiple disciplines the	•				
	lop an understanding of fa	•	-		-	
	ents will be able to define	sensing and controlle	r requirements	for unma	nned vehicle	s that operate
	ferent conditions.					
,	erstand the localization of	Robots.				
11. Lab Con	_					
	itle				C	Os covered
	troduction to mobile robo					iii)
	Iobile robot hardware: loc				i), ii), iii), iv)
	Iobile robot hardware: ser					ii), iii)
	lobile robot control system		are.			i), ii), iii)
	avigation I: localization a					iv)
	avigation II: reasoning an					iv)
	vireless communication for					iii)
8 A	dvanced topics: multiple	robots' coordination				ii)

2.	Course	Computational	L	T		Р		
4.			L	1		1		
	Name	Fluid Dynamics						
		Lab						
3.	Course		0	0		2		
	Code							
4.	Type of	f Course (use tick	Core ()	PF	E (✔)	OE ()	
	mark)				< <i>/</i>			
5.	Pre-	Fluid	6. Frequency	Even	Odd ()	Either	Sem	Every Sen
	requisi	Mechanics	(use tick			0		0
	te (if	•	marks)	(✔)				
	any)							
7.	Total N	umber of Lectures, Tu	ltorials, Practical	(assum	ing 14 weeks	s of one se	emest	er)
	Lectur		Tutorials = 0		ractical = 28			,
8.	Course	Description	I	I				
		nal Fluid Dynamics is	one of the fast-ev	olving	fields engined	ering which	ch tal	kes essentia
	-	om continuum mechani		-	-	-		
	-	to almost all engineerin	-			-		
		-						-
		ng of the basics of C		rning e	quations, mes	sning issu	ies, n	leat transfe
-	-	s and the method of fini	te differences.					
9.		ng Objectives:						
		inderstand the mathematic	atical basis and evo	olution	of the govern	ing equati	ions c	of fluid flow
	and	heat transfer.						
	ii) To s	olve one and two-dime	nsional partial diffe	erential	equations usi	ng traditio	onal (CFD tools.
	iii) To l	earn meshing methods	and intricacies and	techniq	ues of discret	ization.		
	iv) To a	pply the various finite	differencing schem	es to Cl	FD problems.			
	v) To 1	earn the algorithms for	standard CFD prob	olems.	-			
10	. Course	Outcomes (COs): At t	he end of this cour		earner will be	:		
	i) 1		ne chu or this cour	se, the I				ganaration
	1)	Use the knowledge of C			cts of discreti	zation and	d grid	generation
	· ·	Use the knowledge of C Solve fluid flow fields u	CFD techniques, ba	sic aspe	cts of discreti	zation and	d grid	generation
	ii) S iii) S	Solve fluid flow fields u Model fluid flow proble	CFD techniques, ba using CFD methods ems and heat transf	sic aspe s. er.			d grid	generation
	ii) iii) iv)	Solve fluid flow fields u Model fluid flow proble Will be able to verify th	CFD techniques, ba using CFD methods ems and heat transf he different finite so	sic aspe s. er.			d grid	generation
	ii) 5 iii) 1 iv) 7 v) 2	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard	CFD techniques, ba using CFD methods ems and heat transf he different finite so	sic aspe s. er.			d grid	generation
11	ii) 1 iii) 1 iv) 2 v) 2 . Lab Co	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard	CFD techniques, ba using CFD methods ems and heat transf he different finite so	sic aspe s. er.		oach.		
11	ii) iii) iv) v) Lab Co	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard	CFD techniques, ba using CFD methods ems and heat transf he different finite so	sic aspe s. er.		oach.	d grid	
<u>11</u> Sr	ii) : iii) : iv) : v) : Lab Co . No. :	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard ntent Fitle	CFD techniques, ba using CFD methods ems and heat transf ne different finite so CFD practices.	sic aspe s. er. chemes	to CFD appro	oach.		ered
<u>11</u> Sr	ii) { iii) { iv) v . Lab Co . No. { 1. {	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard ntent Fitle	CFD techniques, ba using CFD methods ems and heat transf e different finite so CFD practices.	sic aspe s. er. chemes spiral ca	to CFD appro	oach.		
<u>11</u> Sr	ii) { iii) { iv) { v) { Lab Co No. { 1. {	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard ntent Fitle Fhree-dimensional anal reaction turbine using a	CFD techniques, ba using CFD methods ems and heat transf e different finite so CFD practices.	sic aspe s. er. chemes spiral ca	to CFD appro	oach.		ered
<u>11</u> Sr	ii) { iii) { iv) { v) { Lab Co No. { 1. {	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard ntent Fitle	CFD techniques, ba using CFD methods ems and heat transf e different finite so CFD practices.	sic aspe s. er. chemes spiral ca	to CFD appro	oach.		ered
11 Sr	ii) { iii) { iv) v . Lab Co . No. 7 1. 7 1. 7	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard ntent Fitle Fhree-dimensional anal reaction turbine using a	CFD techniques, ba using CFD methods ems and heat transf ne different finite so CFD practices. ysis of flow in the differently weighte	sic aspe s. er. chemes spiral ca ed Petro	to CFD appro	oach.	s Cov	ered
11 Sr	ii) { iii) { iv) { v) { Lab Co No. { 1. { 1. { 1. { 1. { 1. { 1. { 1. { 1. {	Solve fluid flow fields u Model fluid flow proble Will be able to verify th Algorithm for standard ntent Fitle Fhree-dimensional anal reaction turbine using a method.	CFD techniques, ba using CFD methods ems and heat transf e different finite so CFD practices. ysis of flow in the differently weighter ructure and heat tra	sic aspe s. er. chemes spiral ca ed Petro	to CFD appro asing of a w-Galerkin ne to	oach.	s Cov	ered i)

4.	Numerical study of double-diffusive natural convection in	iii)
	anisotropic porous enclosures.	
5.	Mixed convective flow in vertical channel with a built-in circular	iii), iv)
	cylinder.	
6.	Understanding hinge through CFD.	iv), v)

1. Name of the	he Department- Me	chanical]	Engineer	ring			
2. Course	Press Tools &	L	4	J	.		Р
Name	Dies Lab						
3. Course		0		0)		2
Code							
• •	ourse (use tick	Core ()	EAS	PE (✓)	Special	ization ()
mark)			0				
5. Pre-	Manufacturing	6. Freq	uency	Even	Odd	Either	Every Sem ()
requisite	Processes	(use		(✔)	0	Sem ()	• •
(if any)		marl	ks)				
7. Total Nun	nber of Lectures, T	utorials, P	ractical	(assumi	ng 14 y	weeks of	one semester)
Lectures = 0		Tutorial	s = 0	Practi	cal = 2	8	
8. Course De	escription						
	d dies subject is de					d practica	al knowledge of
	of tools and dies use						
	objectives: Students						
	uaint the methods an	d technolo	ogies invo	olved in	the var	ious press	s working
operati							
	erstand the construct						
	uire the knowledge of						
	lerstand the principle	es, function	ns and de	esign pra	actices	of Jigs, H	Fixtures and dies
	ss working.						
	utcomes (COs): Afte					e student	shall be able to
-	lain with the various	-	-				
	ign the press tools ar	-		01		5.	
-	form press working of	-	-				
iv) To sele	ect and design the jig	s and fixtu	re for dif	ferent d	ies in p	oress work	king operations.
11. Lab Conte	ent						
Sr. No.	Title					CC) covered
1	To perform the ex		with meth	ods invo	olved in	n	i), iii)
2	design of press too				1 1 :-		:\ :::\
2	To perform the ex	periment v	vith meth	ioas invo	orved 11	n	i), iii)
3	metal cutting.	noriment -	with math	oda inv		n	i), ii)
3	To perform the ex open die and punc	-	viui meth	ious mv	Jiveu 11	1	1), 11)
4	To perform the ex		with math	odain	Jund :	n	i), ii)
4	drawing die.	pennent v	vitii meth		Jiveu II	1	1), 11)
5	To perform the ex	narimant .	with math	ode inv	Jund :	n	ii) iii)
3	bending die.	perment v	vitii metn	ious IIIV	Jiveu II	11	ii), iii)
6	¥	noriment -	with math	oda inv		n	ii) iii)
6	To perform the ex	perment v	viui meth	ious mv	Jiveu 11	1	ii), iii)
7	forming die.	nominant	with mail	oda im-	Jund		
/	To perform the ex	penment v	viui meth	ious invo	Jivea 11	11	ii), iii)
0	forging die.	nominant -	with mail	oda im-	Jund		:::)
8	To perform the ex		viui meth	ious inv	Jivea 11	LL I	iii)
	multiple forging d				.1		
9	To perform the ex	-			Dived 11	n	iii)
	Tools for flash trin	nming & I	iole pierc	ing			

10	To perform the experiment with methods involved in	iv)
	locating & clamping	
11	To perform the experiment with methods involved in drilling jigs	iv)
12	To perform the experiment with methods involved in milling fixture	iv)

	Course NameFinite ElementLTAnalysis Lab								Р
3.	Course Code	e		0		(0	2	
4.	Type of Cou	rse (use	e tick mark)	Core ()		PE (✓)	OE ()	EAS ()	BSC (
5.	Pre-requisite any)	e (if	Engineering Mechanics, SO	6.FrequencyOMtick marks		Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Numb	er of Lo	ectures, Tutoria	als, Practical (assumin	g 14 wee	eks of one	semester	·)	<u> </u>
Le	ctures = 0			Tutorials = 0		Practica	l = 28		
8.	Course Desc	ription							
The	e finite elemen	nt analy	sis (FEA) is am	nong one of the most p	owerful	tools for t	he numer	ic solutior	ı of wid
an	nge of enginee	ering pr	oblems. The ag	oplication ranges from	deform	ation and	stress an	alysis of	civil an
			-	ponents, aircraft desi				•	
				completion, students	-		•	-	
	-		fer using FEA.	compretion, statemes	Should c		sorve une	proorein	, in 501
	••••••								
).	Learning Ob	ojective	s:						
	i) Introduce	e studen	ts to MATLAB	software to work on.					
	ii) To enabl	le the s	tudents, underst	tand the mathematical	and phy	vsical prin	ciples un	derlying t	he Finit
				ed to solid mechanics a		-	-		
						5			
	<i>.</i>		e characteristics	s of various finite eleme	ents.				
	iv) To devel	op finite		s of various finite eleme ons for simple and com		nains.			
10		_	e element equati	ons for simple and com	plex don		shall be	able to	
10.	. Course Outo	comes (e element equation COs): After the	ons for simple and come completion of the co	plex don		shall be	able to	
10.	i) Get comf	comes (fortable	e element equati COs): After the in working on N	ons for simple and com e completion of the co MATLAB software.	plex don ourse, th	e student		able to	
10.	 Course Outo i) Get comf ii) Get to kn 	comes (fortable now the	e element equati COs): After the in working on N concepts of Mat	ons for simple and come e completion of the constant MATLAB software. hematical Modeling of	plex don ourse, th Enginee	e student ring Probl	ems.	able to	
10.	 Course Outc i) Get comf ii) Get to kn iii) Get comf 	comes (fortable now the fortable	e element equati COs): After the in working on N concepts of Mat in deciding the	ons for simple and come e completion of the con MATLAB software. Thematical Modeling of geometry of finite elem	pplex don ourse, th Enginee nent for d	e student ring Proble ifferent ca	ems.	able to	
	 Course Outc i) Get comf ii) Get to kn iii) Get comf 	comes (fortable now the fortable ciate the	e element equation COs): After the in working on N concepts of Mat in deciding the e use of FEM to	ons for simple and come e completion of the constant MATLAB software. hematical Modeling of	pplex don ourse, th Enginee nent for d	e student ring Proble ifferent ca	ems.	able to	
11.	 i) Get comf ii) Get to kn iii) Get comf iv) To appre 	comes (fortable now the fortable ciate the	e element equation COs): After the in working on N concepts of Mat in deciding the e use of FEM to	ons for simple and come e completion of the con MATLAB software. Thematical Modeling of geometry of finite elem	pplex don ourse, th Enginee nent for d	e student ring Proble ifferent ca	ems.		overed
11.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 	comes (fortable now the fortable ciate the tailed c	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent	ons for simple and come e completion of the con MATLAB software. Thematical Modeling of geometry of finite elem	pplex don ourse, th Enginee nent for d	e student ring Proble ifferent ca	ems.	CO c	
11.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 	comes (fortable now the fortable ciate the tailed c	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent	ons for simple and come e completion of the condition MATLAB software. Thematical Modeling of geometry of finite element a range of Engineering	pplex don ourse, th Enginee nent for d	e student ring Proble ifferent ca	ems.	CO co	i)
11.	i) Get comfi ii) Get comfi iii) Get to kn iiii) Get comfi iv) To appre . Unit wise de . No. 1 1 2	comes (fortable now the fortable ciate the tailed c	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent	ons for simple and come e completion of the condition MATLAB software. Thematical Modeling of geometry of finite element a range of Engineering	plex don ourse, th Enginee ent for d Problem	e student ring Proble ifferent ca	ems.	CO co	i) i)
11.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 	comes (fortable now the fortable ciate the tailed c luction t LAB co	e element equati COs): After the in working on M concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim	ons for simple and come e completion of the condition MATLAB software. Thematical Modeling of geometry of finite element a range of Engineering of spring systems tensional elasticity prob	plex don ourse, th Enginee ent for d Problem	e student ring Proble ifferent ca	ems.		i) i) i)
11.	Course Outoi) Get comfii) Get to kniii) Get comfiii) Get comfiv) To appreUnit wise deNo.11Introd2MAT34	comes (fortable now the fortable ciate the tailed c luction t LAB co LAB co	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus	ons for simple and come e completion of the conditional definition	plex don ourse, th Enginee ent for d Problem	e student ring Proble ifferent ca	ems.	CO co i), ii	i) i) i), iii)
11.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 4 MAT 5 MAT 	comes (fortable fortable fortable ciate the ciate the tailed c tailed c LAB co LAB co LAB co	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus de for beam ana	ons for simple and come e completion of the condition MATLAB software. Thematical Modeling of geometry of finite element a range of Engineering of spring systems tensional elasticity probess analysis lysis	plex don ourse, th Enginee ent for d Problem	e student ring Proble ifferent ca	ems.	CO co i), ii i), ii	i) i) i)
11.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 4 MAT 5 MAT 6 MAT 	comes (fortable now the fortable ciate the tailed c LAB co LAB co LAB co LAB co	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus de for beam ana de for 2-D fram	ons for simple and come e completion of the conditional definition	plex don ourse, th Enginee ent for d Problem	e student ring Proble ifferent ca	ems.	CO co i), ii i), ii i), ii	i) i) i), iii) i), iii) i), iii)
[1.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 4 MAT 5 MAT 6 MAT 	comes (fortable fortable fortable ciate the ciate the tailed c LAB co LAB co LAB co LAB co LAB co	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus de for beam ana de for 2-D fram de for plane stre	ons for simple and come e completion of the condition (ATLAB software. hematical Modeling of geometry of finite element a range of Engineering of spring systems ensional elasticity probess analysis lysis e analysis ess analysis using CST	Problems	e student ring Proble ifferent ca ns.	ems. ses.	CO co i), ii i), ii i), ii i), ii i), ii	i) i) i) i), iii) i), iii) i), iii) i), iii)
11.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 4 MAT 5 MAT 6 MAT 7 MAT 8 MAT 	comes (fortable fortable ciate the ciate the tailed c LAB co LAB co LAB co LAB co LAB co LAB co	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus de for z-D fram de for plane stre de for one-dime	ons for simple and come e completion of the conditional definition of the conduction of th	plex don ourse, th Enginee ent for d Problem olems element n conside	e student ring Proble ifferent ca ns.	ems. ses.	CO co i), ii i), ii i), ii i), ii i), ii),	i) i) i) i), iii) i), iii) i), iii) i), iii) iii), iv)
[1.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 4 MAT 5 MAT 6 MAT 7 MAT 8 MAT 9 Bars of 	comes (fortable fortable convertion the ciate the ciate the tailed convertion tailed convertion LAB convertion LAB convertion LAB convertion LAB convertion LAB convertion LAB convertion LAB convertion LAB convertion LAB convertion	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus de for z-D fram de for plane stre de for one-dime	ons for simple and come e completion of the condition (ATLAB software. hematical Modeling of geometry of finite element a range of Engineering of spring systems ensional elasticity probess analysis lysis e analysis ess analysis using CST	plex don ourse, th Enginee ent for d Problem olems element n conside	e student ring Proble ifferent ca ns.	ems. ses.	CO co i), ii i), ii i), ii i), ii i), ii),	i) i) i) i), iii) i), iii) i), iii) i), iii)
11. Sr.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 4 MAT 5 MAT 6 MAT 7 MAT 8 MAT 9 Bars of ANS 	comes (fortable fortable fortable ciate the tailed c luction t LAB co LAB co LAB co LAB co LAB co LAB co LAB co LAB co	e element equation COs): After the in working on N concepts of Mation in deciding the gradient e use of FEM to ontent to MATLAB de for analysis of de for One-Dimination de for plane trustion de for plane street de for one-dime ant cross section	ons for simple and come e completion of the conditional definition of the conduction of th	plex don ourse, th Enginee ent for d Problem olems element n conside	e student ring Proble ifferent ca ns.	ems. ses.	CO co i), ii i), ii i), ii i), ii i), ii), ii), ii	i) i) i), iii) i), iii) i), iii) i), iii) iii), iv) ii), iv)
11. Sr.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 3 MAT 4 MAT 5 MAT 6 MAT 7 MAT 8 MAT 9 Bars of ANS 10 Truss 	comes (fortable fortable ciate the tailed c luction t LAB co LAB co LAB co LAB co LAB co LAB co S LAB co LAB co S LAB co S LAB co S LAB co S S S es in AN	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus de for plane stres de for one-dime ant cross section NSYS	ons for simple and come e completion of the conditional MATLAB software. The matical Modeling of geometry of finite elements a range of Engineering of spring systems tensional elasticity probess analysis lysis e analysis e analysis ess analysis using CST ensional heat conduction a area, tapered cross second	plex don ourse, th Enginee ent for d Problem olems element n conside	e student ring Proble ifferent ca ns.	ems. ses.	CO co i), ii i), ii i), ii i), ii i), ii i), ii ii), ii ii), ii	i) i) i), iii) i), iii) i), iii) iii), iv) ii), iv) ii), iv)
11. Sr.	 Course Outo i) Get comf ii) Get to kn iii) Get comf iv) To appre Unit wise de No. Title 1 Introd 2 MAT 3 MAT 4 MAT 5 MAT 6 MAT 7 MAT 8 MAT 9 Bars of ANS 10 Truss 11 Beam 	comes (fortable fortable fortable ciate the tailed c tailed c LAB co LAB co LAB co LAB co LAB co LAB co Sof const YS es in AN s – Sim	e element equati COs): After the in working on N concepts of Mat in deciding the e use of FEM to ontent to MATLAB de for analysis of de for One-Dim de for plane trus de for plane stres de for one-dime ant cross section NSYS	ons for simple and come e completion of the conditional Modeling of geometry of finite elementical Modeling of geometry of finite elementian a range of Engineering of spring systems ensional elasticity probess analysis elysis e analysis ess analysis using CST ensional heat conduction a area, tapered cross sectors antilever, beams with p	plex don ourse, th Enginee ent for d Problem olems element n conside	e student ring Proble ifferent ca ns.	ems. ses.	CO co i), ii i), ii i), ii i), ii i), ii i), ii ii), ii ii), ii	i) i) i), iii) i), iii) i), iii) i), iii) iii), iv) ii), iv)

13	Thermal Analysis – 1D & 2D problem with conduction and convection	ii), iii), iv)
	boundary conditions in ANSYS	

2. Course Name		L	ſ			Р
3. Course Code	Lab	0	0)		2
	f Course (use tick mark)	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
5. Pre- requisi te (if any)	Fluid Mechanics	6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
	umber of Lectures, Tutoria	, .			ne semest	er)
Lectures =	= 0 Description	Tutorials = 0	Practica	$\mathbf{l} = 28$		
 10. Course i) Une ii) Dif iii) Ide iv) Get 	know the details of various type e Outcomes (COs): After the derstand the subject and its te ferentiate the types of vehicle ntify the various types of force basic idea on safety and con omponent	e completion of the echnological signifi e body which are us ces.	course, the cance.		nall be abl	le to
Sr. No.	Title				COs cov	ered
1	Study of different types of				i),	::)
1		car and Bus body.				11)
2	Study of driver's visibility	-			i),	ii)
	Study of driver's visibilityStudy about safety equipm	& space in the car				
2		& space in the car nent's of vehicle.			i), ii	ii)
2 3	Study about safety equipm	& space in the car nent's of vehicle.	he car.		i), ii i),	ii)), iii)
2 3 4	Study about safety equipm Study about the various pa	& space in the car nent's of vehicle. inting process on the car icle crash condition	he car. 18.		i), ii i), i), ii	ii)), iii) iii)

8	Study about the different types of commercial vehicle body.	i), ii), iii)
9	Study and perform wind tunnel test on models like aero foil & cylinder.	i), iii)
10	Study about different types of material used in vehicle body construction.	i), ii), iii)

	e of the Depar	MEMS & Micro-	<u>т</u>	Г	1	1	D
2. Cour	se Name	Systems Lab	L				Р
3. Cour	se Code		3	0		(0
4. Type	of Course (us	e tick mark)	Core ()	PE (✓)		EAS ()	BSC ()
5. Pre-r	equisite (if	Mechatronics	6. Frequency (use	Even	Odd ()	Either	Every
any)	-	Systems and Its	tick marks)	(✔)		Sem ()	Sem ()
•		Applications					
7. Total	Number of L	ectures, Tutorials, P	ractical (assuming 14 w	eeks of one	semester)	
Lectures	= 0		Tutorials = 0	Practica	l = 28		
8. Cour	se Description	l					
MEMS a	and Microsyste	em, Typical MEMS	and Microsystems Pro	ducts, Evol	lution of	Microfat	orication
Microsys	tems and Micro	oelectronics, Multidis	ciplinary Nature of Micr	osystems, N	liniaturiz	ation. App	olication
and Mark	ets.						
9. Lear	ning objective	s:					
i) T	o provide knov	wledge of semiconduc	tors and solid mechanics	to fabricate	MEMS d	evices	
ii) T	o educate on th	ne rudiments of Micro	fabrication techniques.				
iii) T	o introduce the	e working principle of	Sensors and Actuators.				
iv) T	o introduce van	rious sensors & actuat	ors their applications.				
10. Cour	se Outcomes ((COs):					
i) K	Lnow the basic	concepts of MEMS st	ructures under different r	nodes of ope	eration an	d characte	ristics.
ii) U	Inderstand the f	fundamentals on solvi	ng the problem based on	MEMS strue	cture.		
iii) G	ain the experti	se on fundamentals of	MEMS design and operation	ation.			
iv) U	Inderstand the	design concepts of Ml	EMS sensors and actuator	for practica	l applica	tions	
11. Lab (Component						
Sr. No.	Title					COs Cov	vered
1	Study of Inte						
	devices.	lliSuite Software for	the design and fabrication	n process of	MEMS	i), ii), i	
2	Deflection Re	lliSuite Software for	the design and fabrication	n process of	MEMS	i), ii), i	
2	Demeetion re		the design and fabrication on –On –Insulator) Pressu		MEMS	i), ii), i i), ii), i	iii), iv)
3			on –On –Insulator) Pressu		MEMS		iii), iv) iii), iv)
	Construction	esponse of SOI (Silico and Simulation of RF	on –On –Insulator) Pressu	ire Sensor	MEMS	i), ii), i	iii), iv) iii), iv) iii), iv)
3	Construction Determinatio	esponse of SOI (Silico and Simulation of RF n of Capacitance char	on –On –Insulator) Pressu 7 Switch	e Sensor		i), ii), i i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv)
3	Construction Determinatio	esponse of SOI (Silico and Simulation of RF n of Capacitance char	on –On –Insulator) Pressu 7 Switch nge in Capacitive Pressure	e Sensor		i), ii), i i), ii), i i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv)
3	Construction Determinatio Studies on ef RF Switch	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu	on –On –Insulator) Pressu 7 Switch nge in Capacitive Pressure	e Sensor ver beam en	nployed	i), ii), i i), ii), i i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv) iii), iv)
3 4 5	Construction Determinatio Studies on ef RF Switch Estimation of	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu f Resistance change ir	on –On –Insulator) Pressu Switch nge in Capacitive Pressure Ill –in Voltage of Cantile	e Sensor ver beam en ssure Sensor	nployed	i), ii), ii i), ii), ii i), ii), ii i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv)
3 4 5 6	Construction Determinatio Studies on ef RF Switch Estimation of	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu f Resistance change ir	on –On –Insulator) Pressu Switch nge in Capacitive Pressure Ill –in Voltage of Cantile	e Sensor ver beam en ssure Sensor	nployed	i), ii), ii i), ii), ii i), ii), ii i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv)
3 4 5 6	Construction Determinatio Studies on ef RF Switch Estimation of Studies on ef Switch.	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu f Resistance change ir fect of Air Gap on Pu	on –On –Insulator) Pressu Switch nge in Capacitive Pressure Ill –in Voltage of Cantile	e Sensor ver beam en ssure Senso am employe	nployed r d in RF	i), ii), ii i), ii), ii i), ii), ii i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv)
3 4 5 6 7	Construction Determinatio Studies on ef RF Switch Estimation of Studies on ef Switch.	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu f Resistance change ir fect of Air Gap on Pu Construction of differe	on –On –Insulator) Pressu Switch nge in Capacitive Pressure Ill –in Voltage of Cantile SOI Piezo –resistive Pre Il –in voltage of fixed be	e Sensor ver beam en ssure Senso am employe	nployed r d in RF	i), ii), ii i), ii), ii i), ii), ii i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv)
3 4 5 6 7	Construction Determinatio Studies on ef RF Switch Estimation of Studies on ef Switch. Design and C of its natural	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu f Resistance change ir fect of Air Gap on Pu Construction of different frequency	on –On –Insulator) Pressu Switch nge in Capacitive Pressure Ill –in Voltage of Cantile SOI Piezo –resistive Pre Il –in voltage of fixed be	e Sensor ver beam en ssure Sensor am employe s and detern	nployed r d in RF nination	i), ii), ii i), ii), ii i), ii), ii i), ii), i	 iii), iv)
3 4 5 6 7 8	Construction Determinatio Studies on ef RF Switch Estimation of Studies on ef Switch. Design and C of its natural	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu f Resistance change ir fect of Air Gap on Pu Construction of different frequency	on –On –Insulator) Pressu Switch nge in Capacitive Pressure III –in Voltage of Cantile SOI Piezo –resistive Pre II –in voltage of fixed be nt types of Accelerometer	e Sensor ver beam en ssure Sensor am employe s and detern	nployed r d in RF nination	i), ii), ii i), ii), ii i), ii), ii i), ii), i	 iii), iv)
3 4 5 6 7 8	Construction Determinatio Studies on ef RF Switch Estimation of Studies on ef Switch. Design and C of its natural Design and software.	esponse of SOI (Silico and Simulation of RF n of Capacitance chan fect of Air Gap on Pu f Resistance change ir fect of Air Gap on Pu Construction of different frequency Analysis of Piezores	on –On –Insulator) Pressu Switch nge in Capacitive Pressure III –in Voltage of Cantile SOI Piezo –resistive Pre II –in voltage of fixed be nt types of Accelerometer	e Sensor ver beam en ssure Sensor am employe s and determ ng Covento	nployed r d in RF nination r Ware	i), ii), ii i), ii), ii i), ii), ii i), ii), i	iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv) iii), iv)

1. Name	· · · · ·						
2. Cours	e Name	EV Charging Infrastructure Technology Lab	L		T]	P
3. Cours	e Code		0		0		2
4. Type	of Course (us	e tick mark)	Core ()	PE (✓)		OE ()	
5. Pre-re	equisite (if	Introduction to	6. Frequency (use	Even	Odd ()	Either	Every
any)		Electric and Hybrid Vehicle	tick marks)	(✔)		Sem ()	Sem ()
		ectures, Tutorials, P	Practical (assuming 14 w)	
Lectures :	= 0		Tutorials = 0	Practic	al = 28		
8. Cours	e Description						
The mater	ial for this cou		pts, principles, analysis a in such a manner that it iduate students.	0	•		
	ing objectives						
i)		•	for better performance.				
ii)		the EV charging con					
iii)							
iii)		t the Batteries used in	n EV.				
iv)	Understand	t the Batteries used in the infrastructure of	n EV. Charging stations of EV.	41-2-24-24-2	-411 lb	h1. 4.	
iv) 10. Cours	Understand e Outcomes (t the Batteries used ir the infrastructure of COs): On successful	n EV. Charging stations of EV. completion of this course	e, the studer	nt will be a	ible to	
iv) 10. Cours i)	Understand e Outcomes (Elaborate v	t the Batteries used in the infrastructure of COs): On successful arious technical parag	n EV. Charging stations of EV. completion of this course meters of batteries.			ble to	
iv) 10. Cours i) ii)	Understand e Outcomes (Elaborate v Distinguish	t the Batteries used ir the infrastructure of COs): On successful arious technical parati between various type	n EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E			ble to	
iv) 10. Cours i) ii) iii)	Understand e Outcomes (Elaborate v Distinguish Develop ba	t the Batteries used in the infrastructure of COs): On successful arious technical parate between various type ttery charger for an E	n EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E EV			ble to	
iv) 10. Cours i) ii) iii) iii) iv)	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an	t the Batteries used ir the infrastructure of COs): On successful arious technical parati between various type	n EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E EV			ible to	
iv) 10. Cours i) ii) iii)	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an	t the Batteries used in the infrastructure of COs): On successful arious technical parate between various type ttery charger for an E	n EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E EV			СО	s ered
iv) 10. Cours i) ii) iii) iii) iv) 11. Lab C	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an content Title	t the Batteries used in the infrastructure of COs): On successful arious technical parate between various type ttery charger for an E	n EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E EV ng Infrastructure.			СО	_
iv) 10. Cours i) ii) iii) iv) 11. Lab C Sr. No.	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an content Title To Stu	t the Batteries used ir the infrastructure of COs): On successful arious technical parate between various type ttery charger for an E d Design the Chargin	n EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E EV ng Infrastructure.	V applicatio		СО	ered
iv) 10. Cours i) ii) iii) iv) 11. Lab C Sr. No.	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an Content Title To Stu To Stu	t the Batteries used ir the infrastructure of COs): On successful arious technical parate between various type ttery charger for an E d Design the Chargin	h EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E EV ng Infrastructure. stem of EV. pes of chargers used in E	V applicatio		СО	ered i)
iv) 10. Cours i) ii) iii) iv) 11. Lab C Sr. No. 1 2	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an content Title To Stu To Stu	t the Batteries used in the infrastructure of COs): On successful arious technical parat- between various typ- ttery charger for an E d Design the Chargin dy about charging sy dy about different typ ly about Lead-acid ba	h EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E EV ng Infrastructure. stem of EV. pes of chargers used in E	V applicatio		СО	i)
iv) 10. Cours i) ii) iii) iv) 11. Lab C Sr. No. 1 2 3	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an content Title To Stu To Stu To stuc	t the Batteries used in the infrastructure of COs): On successful arious technical parat- between various typ- ttery charger for an E d Design the Chargin dy about charging sy dy about different typ ly about Lead-acid ba	h EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E' EV ag Infrastructure. stem of EV. pes of chargers used in E' attery system ance of Lead-acid battery	V applicatio		СО	ered i) i) i)
iv) 10. Cours i) ii) iii) iii) iv) 11. Lab C Sr. No. 1 2 3 4	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an content To stue To Stue To stue To stue	t the Batteries used in the infrastructure of COs): On successful arious technical parat- between various typ- ttery charger for an E d Design the Chargin dy about charging sy dy about different typ dy about Lead-acid ba-	n EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E' EV ng Infrastructure. stem of EV. pes of chargers used in E' attery system ance of Lead-acid battery ed battery system.	V applicatio		СО	ered i) i) ii) iii)
iv) 10. Cours i) ii) iii) iii) iv) 11. Lab C Sr. No. 1 2 3 4 5	Understand e Outcomes (Elaborate v Distinguish Develop ba Develop an content Title To Stu To Stu To stud To stud To stud	t the Batteries used in the infrastructure of COs): On successful arious technical parat- between various typ- ttery charger for an E d Design the Chargin dy about charging sy dy about different typ dy about Lead-acid bar dy about the performa- dy about sodium-base	h EV. Charging stations of EV. completion of this course meters of batteries. es of batteries used for E' EV ng Infrastructure. stem of EV. pes of chargers used in E' attery system ance of Lead-acid battery ed battery system. arging system.	V applicatio		СО	ered i) i) i) ii) ii) ii)

7th Semester

2.	Course Name	Automation in	Engineering L	Т		1	P
-•	Course Maine	Manufacturing	L	1		1	Γ
3.	Course Code		3	0			0
4.	Type of Course (us	e tick mark)	Core (✓)	PE ()		OE ()	-
5.	Pre-requisite (if	Manufacturing	6. Frequency (use	Even ()	Odd	Either	Every
	any)	Processes and	tick marks)		(✓)	Sem ()	Sem ()
		Technology &	,			V V	
		Engineering					
		Graphics and					
		Design					
7	Total Number of L		ractical (assuming 14	weeks of one	somostor	<u> </u>	
	1000000000000000000000000000000000000	cetures, rutoriais, r	Tutorials = 00	Practical =)	
8.	Course Description			Tructicui –	00		
			nputer systems to assis	t in the creation	n. modifi	cation. an	alvsis, oʻ
		•	d to increase the produc				•
-	-		locumentation, and to o	-	-	-	
	0 1	U	for print, machining, or				U
	*		s in the Product develop		0		
	-		working in the manufac	· · · ·			incenting
	Learning objectives	<u> </u>	working in the manufac		intent.		
9.	0		M and concepts of com	nuter graphics			
		ne geometric issues co	ncerned with manufact	uring and its i	elated are	eas.	
		-	oncerned with manufact he manufacturing persp	-			
	iii) To understand the	-	he manufacturing persp	-			
10	iii) To understand thiv) To have an idea	ne latest advances in the of Computer Integrate	he manufacturing persp	ectives and th	eir applic		
10	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th 	ne latest advances in the of Computer Integrate (COs): On completion ne importance of CAD	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro-	ectives and th ents will be al	eir applica		
10	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop program 	ne latest advances in the of Computer Integrate (COs): On completion ne importance of CAE grams related to manual	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro facturing using codes.	ectives and th ents will be all oduct develop	eir applica ole to ment.		
10	 iii) To understand therein it is to have an idea Course Outcomes (i) To understand therein it is to develop program it is to understand therein it is to	the latest advances in the of Computer Integrate COs): On completion the importance of CAE grams related to manu- the concept of group te	he manufacturing persp ed Manufacturing. of this course, the stud O/CAM principles in Pro facturing using codes. chnology and flexible r	ectives and th ents will be al oduct develop	eir applica ole to ment.		
	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in 	the latest advances in the of Computer Integrate (COs): On completion the importance of CAE grams related to manu- the concept of group tee in details about compu	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro facturing using codes.	ectives and th ents will be al oduct develop	eir applica ole to ment.		
11	 iii) To understand therein it is the initial term in the initial term is an idea initial term initia	the latest advances in the of Computer Integrate COs): On completion the importance of CAE grams related to manu- the concept of group teen details about compu- content	he manufacturing persp ed Manufacturing. of this course, the stud O/CAM principles in Pro facturing using codes. chnology and flexible r ter integrated manufact	ectives and th ents will be al oduct develop nanufacturing uring.	eir applica ole to ment. system.	ations.	
11	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in 	ne latest advances in the of Computer Integrate COs): On completion ne importance of CAD grams related to manuate ne concept of group teen details about compu- content Number of	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro facturing using codes. chnology and flexible r ter integrated manufacture Title of the unit: Co	ectives and th ents will be al oduct develop nanufacturing uring.	eir applica ole to ment. system.	ations.	of
11 Ur	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in Unit wise detailed of 	he latest advances in the of Computer Integrate (COs): On completion the importance of CAE grams related to manuate the concept of group tee the details about computer (Number of lectures = 12	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard	eir applic: ole to ment. system. ware & F	ations. Principles	
11 Ur Pro	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in Unit wise detailed of it-1 	the latest advances in the of Computer Integrate COs): On completion the importance of CAD grams related to manu- the concept of group terned a details about compu- content Number of lectures = 12 Cycle – Graphics disp	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufacture Title of the unit: Con Computer Graphics play devices – CRT, c	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard olour CRT m	eir applica ole to ment. system. ware & F	ations. Principles	at- pane
11 Ur Pro	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in Unit wise detailed of it-1 	the latest advances in the of Computer Integrate (COs): On completion the importance of CAD type and the concept of group teans related to manual the concept of group teans the details about computer to details about computer (Number of lectures = 12 Cycle – Graphics disputer t Devices – Printers a	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics play devices – CRT, c and Plotters – Graphics	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard olour CRT m Standards –	eir applica ole to ment. system. ware & F nonitors, 1 Neutral F	rinciples DVST, Flile format	at- pane s –IGES
11 Ur Pro dis ST	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in Unit wise detailed of it-1 	he latest advances in the of Computer Integrate COs): On completions he importance of CAD grams related to manuar he concept of group terned he details about computer content Number of lectures = 12 Cycle – Graphics disputer t Devices – Printers and hetric transformations,	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufacture Title of the unit: Con Computer Graphics olay devices – CRT, c and Plotters – Graphics Matrix representation-	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – 1 translation, sc	eir applica ole to ment. system. ware & P nonitors, 1 Neutral Fi caling, she	Principles DVST, Fl ile formationaries	at- pane s –IGES ation and
11 Ur Pro dis ST ref	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in Unit wise detailed of it-1 	he latest advances in the of Computer Integrate COs): On completions he importance of CAD grams related to manuar he concept of group teans he details about computer content Number of lectures = 12 Cycle – Graphics disputer t Devices – Printers and hetric transformations, insformations, concate	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics play devices – CRT, c and Plotters – Graphics	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – 1 translation, sc	eir applica ole to ment. system. ware & P nonitors, 1 Neutral Fi caling, she	Principles DVST, Fl ile formationaries	at- pane s –IGES ation and
11 Ur dis ST ref Br	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand th iv) To understand in Unit wise detailed of it-1 	The latest advances in the of Computer Integrate COs): On completions the importance of CAD grams related to manu- the concept of group terned a details about compu- content Number of lectures = 12 Cycle – Graphics disputed the Devices – Printers and netric transformations, concater and DDA	he manufacturing persp ed Manufacturing. of this course, the stud O/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics play devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw	ectives and the ents will be all oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – I translation, sc are, Graphics	eir applica ole to ment. system. ware & F monitors, I Neutral Fi caling, she functions	Principles DVST, Fl ile formationaries	at- pane s –IGES ation and
11 Ur dis ST ref Br	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in Unit wise detailed of it-1 	he latest advances in the of Computer Integrate COs): On completions he importance of CAD grams related to manuar he concept of group teans he details about computer content Number of lectures = 12 Cycle – Graphics disputer t Devices – Printers and hetric transformations, insformations, concate	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufacture Title of the unit: Con Computer Graphics olay devices – CRT, c and Plotters – Graphics Matrix representation-	ectives and the ents will be all oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – I translation, sc are, Graphics	eir applica ole to ment. system. ware & F monitors, I Neutral Fi caling, she functions	Principles DVST, Fl ile formationaries	at- pane s –IGES ation and
11 Ur dis ST ref Br	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand th iv) To understand in Unit wise detailed of it-1 	The latest advances in the of Computer Integrate COs): On completions the importance of CAD grams related to manu- the concept of group terned a details about compu- content Number of lectures = 12 Cycle – Graphics disputed the Devices – Printers and netric transformations, concater and DDA	he manufacturing persp ed Manufacturing. of this course, the stud O/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics play devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw	ectives and the ents will be all oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – I translation, sc are, Graphics	eir applica ole to ment. system. ware & F monitors, I Neutral Fi caling, she functions	Principles DVST, Fl ile formationaries	at- pane s –IGES ation and
11 Ur Prodiss ST ref Br Ur	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand th iv) To understand in Unit wise detailed of it-1 	he latest advances in the of Computer Integrate COs): On completions the importance of CAD grams related to manual the concept of group teans a details about computer content Number of lectures = 12 Cycle – Graphics disputer t Devices – Printers and t Devices – Printers and t Devices – Printers and t DDA Number of lectures = 10 C, DNC- Manual part 1	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics play devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw Title of the unit: CN Programming – Compute	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – 1 translation, sc are, Graphics C Machine T	eir applica ole to ment. system. ware & P nonitors, I Neutral Fi- caling, she functions ools art Program	rinciples Principles DVST, Fl ile formati earing, rota , output pr	at- pane s –IGES ation and imitives Examples
11 Ur Pro dis ST ref Br Ur Int	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand th iv) To understand in Unit wise detailed of it-1 	he latest advances in the of Computer Integrate COs): On completions the importance of CAD grams related to manual the concept of group teans a details about computer content Number of lectures = 12 Cycle – Graphics disputer t Devices – Printers and t Devices – Printers and t Devices – Printers and t DDA Number of lectures = 10 C, DNC- Manual part 1	he manufacturing persp ed Manufacturing. of this course, the stud O/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics olay devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw Title of the unit: CN	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – 1 translation, sc are, Graphics C Machine T	eir applica ole to ment. system. ware & P nonitors, I Neutral Fi- caling, she functions ools art Program	rinciples Principles DVST, Fl ile formati earing, rota , output pr	at- pane s –IGES ation and imitives Examples
11 Ur dis ST ref Br Ur Int	iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in . Unit wise detailed of it-1 oduct Development Co play, Graphics output EP.2D and 3Dn geom lection, composite trans- esenham's Algorithm it - 2 roduction to NC, CNC ng NC codes- Adapt	he latest advances in the of Computer Integrate COs): On completions the importance of CAD grams related to manual the concept of group teans a details about computer content Number of lectures = 12 Cycle – Graphics disputer t Devices – Printers and t Devices – Printers and t Devices – Printers and t DDA Number of lectures = 10 C, DNC- Manual part 1	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics olay devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw Title of the unit: CN Programming – Compute d cycles and subroutir	ectives and th ents will be al oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – 1 translation, sc are, Graphics C Machine T	eir applica ole to ment. system. ware & P nonitors, I Neutral Fi- caling, she functions ools art Program	rinciples Principles DVST, Fl ile formati earing, rota , output pr	at- pane s –IGES ation and imitives Examples
11 Ur Prodiss ST ref Br Ur Int usi pro	iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand in . Unit wise detailed of it-1 oduct Development Co play, Graphics output EP.2D and 3Dn geom lection, composite trans- esenham's Algorithm it - 2 roduction to NC, CNC ng NC codes- Adapt	he latest advances in the of Computer Integrate COs): On completions the importance of CAD grams related to manual the concept of group ternations about compu- tion details about compu- content Number of lectures = 12 Cycle – Graphics disput t Devices – Printers about concate and DDA Number of lectures = 10 C, DNC- Manual part Integrated tive Control – Cannegrations (Concert) Number of (Concert) C, DNC- Manual part Integrated) Control – Cannegrations (Concert) Control – Cannegrations (Concert) Concert) Control – Cannegrations (Concert) Control – Concert) Control – Concert Concert Control – Concert	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics olay devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw Title of the unit: CN Programming – Compute d cycles and subroutir	ectives and th ents will be all oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – 1 translation, sc are, Graphics C Machine T ter Assisted Pa tes – CAD /	eir applica ole to ment. system. ware & P nonitors, I Neutral Fi- caling, she functions ools art Program CAM app	Principles DVST, Fl ile formati earing, rota , output pr mming – H proach to	at- pane s –IGES ation and imitives Examples NC par
11 Ur Prodiss ST ref Br Ur Int usi pro	 iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand th i	he latest advances in the of Computer Integrate COs): On completions the importance of CAD grams related to manual the concept of group teans the concept of group te	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics play devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw Title of the unit: CN Programming – Computed cycles and subroutir m 3D models.	ectives and th ents will be all oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – 1 translation, sc are, Graphics C Machine T ter Assisted Pa tes – CAD /	eir applica ole to ment. system. ware & P nonitors, I Neutral Fi- caling, she functions ools art Program CAM app	Principles DVST, Fl ile formati earing, rota , output pr mming – H proach to	at- pane s –IGES ation and imitives Examples NC par
11 Ur Prodiss ST ref Br Ur Int usi pro Ur	iii) To understand th iv) To have an idea Course Outcomes (i) To understand th ii) To develop prog iii) To understand th iv) To understand th iv) To understand in . Unit wise detailed of it-1 oduct Development C play, Graphics output EP.2D and 3Dn geom lection, composite trans- esenham's Algorithm it - 2 roduction to NC, CNC ng NC codes- Adapt ogramming – APT lan it - 3	ne latest advances in the of Computer Integrateof Computer IntegrateCOS): On completionne importance of CAEgrams related to manualne concept of group ten details about computecontentNumber oflectures = 12Cycle – Graphics dispt Devices – Printers anetric transformations, concateand DDANumber oflectures = 10C, DNC- Manual part Itive Control – Canneguage, machining fromNumber oflectures = 10	he manufacturing persp ed Manufacturing. of this course, the stud D/CAM principles in Pro- facturing using codes. chnology and flexible r ter integrated manufact Title of the unit: Con Computer Graphics play devices – CRT, c and Plotters – Graphics Matrix representation- nation – Graphics softw Title of the unit: CN Programming – Computed cycles and subroutir m 3D models.	ectives and the ents will be all oduct develop nanufacturing uring. nputer Hard olour CRT m Standards – I translation, sc are, Graphics C Machine T er Assisted Pa les – CAD / oup Technolo	eir applic: ole to ment. system. ware & F monitors, I Neutral Fi caling, she functions cools art Prograf CAM app gy, CAPI	Principles Principles DVST, Fl ile format earing, rota , output pr mming – H proach to P and FM	at- pane s –IGES ation and timitives Example NC par

concept-transfer systems – head changing FMS – Introduction to Rapid prototyping, Knowledge Based Engineering.

Unit – 4	Number of	Title of the unit: Computer Integrated Manufacturing
	lectures = 10	

CIM wheel – CIM Database- CIM-OSI Model– Networking Standards in CIM Environment – Network structure – Network architecture –TCP/IP, MAP – Virtual Reality, Augmented Reality- Artificial Intelligence and Expert system in CIM, Current industry trends.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books	Recommended

Text Book

i) Mikell P. Groover (2008), Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Pearson Education. ISBN: 978-8-120-33418-2.

Reference Books

- i) Ibrahim Zeid (2009), Mastering CAD/CAM, 2nd Edition, Tata McGraw Hill International Edition, ISBN: 978-0-070- 15134-5.
- **ii**) P N Rao (2010), CAD/CAM Principles and Applications, 3rd Edition, Tata McGraw-Hill Education, ISBN: 978-0-070- 68193-4.
- iii) James A. Rehg and Henry W. Kraebber (2004), Computer Integrated Manufacturing, 3rd Edition, Pearson Education, ISBN: 978-0-131-13413-3

Department Electives-IX

2.	Course Name	Nuclear Power Engineering	L	[]	Г]	Р
3.	Course Code		3		0		0
4.	Type of Course (us	e tick mark)	Core ()	PE (✓)		OE ()	
	Pre-requisite (if	Engg.	6. Frequency (use	Even ()	Odd	Either	Every
	any)	Thermodynamics	tick marks)		(✔)	Sem ()	Sem (
7.		ectures, Tutorials, Pi	ractical (assuming 14 wee	eks of one	semester	·)	
	ctures = 42	, ,	Tutorials = 0	Practica		/	
8.	Course Description						
pov pro was of 1 and	ver from nuclear fue cessing of nuclear fue ste to their safely disp nuclear processes inve al also have understance	els. This involves stu el to merits and deme posal. Upon completio olved in nuclear powe	e principles, techniques an adying and exploring var rits of various nuclear read n of this course students w er generation, know working generation and safety rules	ious aspect ctors and t ill be able ng and pro-	ets of sci from repro to have b os & cons	ence rang ocessing o etter unde of various	ing from of nucles rstandir s reactor
10.	 iii) Give understand iv) Learn about how Course Outcomes (i) Know the nucleation ii) Understand the vertice 	ing of Separators used to dispose the waste	and get protected from rad of this course, the student rocesses. eactors	liations.			
	iv) Able to apply the	e concepts of waste di	sposal and radiation protec	ction.			
11.	Unit wise detailed o	content					
Un	it-1	Number of lectures = 10	Title of the unit: Nuclea	r Reactor	:s		
Rea		tors – Design and con	lioactivity – Decay chains struction of nuclear reacto				
Un	it – 2	Number of lectures = 10	Title of the unit: Reacto	or Materia	als, Repro	ocessing	
Co Nu	nversion to UF4 and U	UF6 – Other fuels like	ear fuels – Uranium – Pro Zirconium, Thorium, Ber tics - Role of solvent ext	ylium.			
	it – 3	Number of	Title of the unit: Separa	ation of R	eactor Pr	oducts	
	-	lectures = 11	· · · · · · · · · · · · · · · · · · ·				
TT.			olution - Precipitation proc Thorax processes - Oxid		-		

Unit –	- 4 Number of Title of the unit: Waste Disposal and Radiation Protect	ion
	lectures = 11	
Types	of nuclear wastes - Safety control and pollution control and abatement - International convention	n on
	aspects – Radiation hazards prevention.	
12. Br	rief Description of self-learning / E-learning component	
The stu	udents will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures	3
deliver	red by subject experts of SGT University.	
The lin	nk to the E-Learning portal.	
https://	/sgtlms.org	
	l papers; Patents in the respective field.	
13. Bo	ooks Recommended	
Text B	Book	
i)	Janet Wood (2007), Nuclear Power, Institution of Engineering and Technology. ISBN: 978-	
	0-863-41668-2.	
Refere	ence Books	
i)	Samuel Glasstone, Alexander Sesonske (2012), Nuclear Reactor Engineering: Reactor Systematic Systematics and State	stems
	Engineering, 4th Edition, CBS Publisher. ISBN: 978-1-461-35866-4.	
ii)	J. Kenneth Shultis, Richard E. Faw, Marcel Dekker (2002), Fundamentals of Nuclear Science	e and
	Engineering, Marcel Dekker. ISBN: 978-0-824-70834-4.	
iii)) Samuel Glasstone (1994), Nuclear Reactor Engineering: Reactor Design Basics, Volume-1, 4th Ed	lition
• `	Kluwer Academic Publishers. ISBN: 9780412985218	5000
iv)	 A.E. Walter and A.B. Reynolds (1981), Fast Breeder Reactor, Pergamon Press, ISBN: 978-0-080-2. 6. 	5982

1.	Name of t	he Department- Mecha	nical Engineering	5			
2.	Course Name	Machine Tool Technology	L	,	Т		Р
3.	Course Code		3		0		0
4.	Type of C	ourse (use tick mark)	Core ()	PE (✔)	OE ()	EAS ()	BSC ()
5.	Pre- requisite (if any)		6. Frequenc y (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Nun	nber of Lectures, Tutor	ials, Practical (as	suming 14 w	veeks of o	one semest	ær)
	Lectures =	= 42	Tutorials = 0	Practio	cal = 0		
8.	Course De	escription	•				

Study of different machine tools and hence educates the students about the scope of the subject. To train the students in the metal cutting domain so as to equip them with adequate knowledge about the various processes. To emphasize upon the prominent theories, concepts and constructional features of machines related to them. To provide an insight about the super finishing operations of gear generating. To lay groundwork for further studies in manufacturing stream.

9. Learning objectives:

sideways.

- i) The course provides students with fundamental knowledge and principles of tool design.
- ii) To demonstrate the fundamentals of machining tool guide ways.
- iii) To develop fundamental knowledge of gear generating processes.
- iv) Understand the basics of press tool engineering and jigs- fixtures.

10. Course Outcomes (COs): The curriculum of the Department is designed to satisfy the diverse needs of students.

- i) Understand the cutting tool geometry, mechanism of machine tool design.
- ii) Understand the machining tool guide ways to produce a component.
- iii) Acquire knowledge of gear generation process with applications, advantages and disadvantages
- iv) Acquire knowledge of the basics of press tool engineering and jigs- fixtures.

Unit-1	Number of lectures	Title of the unit: Introduction Machine Tools Design
	= 11	
1		esign, engineering design process applied to machine tool,
Desisn of mac		esign, engineering design process applied to machine tool, olumn, housing, materials and profile of machine tool
-		
Desisn of mac		

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Unit – 3	Number of lectures = 10	Title of the unit: Gear Generating Process
Introduction to	Gear generating process,	, gear shaping, gear hobbling, Gear shaving, copying machine.

Unit – 4	Number of lectures	Title of the unit: Press Tool Engineering and Jigs &
	= 11	Fixture

Design of punches and dies. Classification based on operation classification based on constructional and operation. Design of drawing dies, factors affecting drawing, design procedure for drawing die, Introduction to jigs and mixture, types of Jigs and fixtures locations, Design of jigs, design of fixture.

12. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) PC Sharma, A text book of Production Engineering, S. Chand, 2009, ISBN: 8121901111. Reference Books

Reference Books

- i) Rao PN; Manufacturing Technologies, 2017, Fourth Edition, McGraw Hill Education, ISBN:1259062570.
- **ii**) Victor Repp and Williard McCarthy, Machine Tool Technology, Career Education, ISBN: 0026715708.

1. Name of the Depar	tment- Mechanical F	Ingineering				
2. Course Name	Recent Trends in	L]	Г]	P
	Automotive					
	Technology					
3. Course Code		3	(0)
4. Type of Course (us	 e tick mark)	Core ()	PE (✓)	-	OE ()	-
5. Pre-requisite (if	IC Engines,	6. Frequency (use	Even ()	Odd	Either	Every
	Automobile	tick marks)		(✓)	Sem ()	Sem ()
any)	Engineering	uck marks)		(•)	Selli ()	Sem ()
7. Total Number of L	0 0	L ractical (assuming 14 wee	ke of one	somostor)	
Lectures = 42		Tutorials = 0	Practica)	
			Tacuca	u = 0		
8. Course Description This course provides students a synopsis of latest trends in automotive industry used in evaluation of world.						
-	• •		-			
	This includes understanding the basic principles of various hybrid and electric vehicles with importance,					
applications and limitati						
	9. Learning objectives:					
	suspension, brakes and	•				
	vehicle operation and					
	Electric and Hybrid V					
iv) Understand the	Latest Engine Technol	logy Features and 42 Volt	Systems.			
10. Course Outcomes	(COs): On completion	of this course, the student	s will be a	ble to		
i) Know the Hybr	id, Battery and Magne	tic track Vehicle.				
ii) Describe the con	mputer control in auto	motive.				
iii) Describe the wo	orking of vehicle for sa	fe ad fast travel.				
	trend in Automotive I					
11. Unit wise detailed		<u> </u>				
Unit-1	Number of	Title of the unit: Future	of Auton	notive Inc	lustry	
	lectures = 11				J	
Challenges and Concen		, crucial issues facing the	industry a	nd annroa	ches to m	eet these
challenges.	is for the 21 century	, erderar issues racing the	industry d	na appioa	enes to m	eet mese
e	r Vehicles: What is fu	el cell, Type of fuel cell, A	dvantage	s of fuel c	all? curren	t state of
		ntages and disadvantages of	•			it state of
Unit – 2	Number of	Title of the unit: Electri			hiolog	
$\operatorname{Omt} = 2$	lectures = 10		cai allu II	lybriu ve	meles	
Types of hybrid systems		l ntages of hybrid systems. C	umont stat		davalann	ants and
		hages of hydrid systems. C	urrent stat	us, ruture	developii	ients and
Prospects of Hybrid Vel		· • • • • • • • • • • • • • • • • • • •	1 111		1. 1	
		tive Braking, Advanced lea				
	elopment of new energy	rgy storage systems, Deep	o discharg	ge and rap	old charge	ng ultra-
capacitors.	-	Γ				
Unit – 3	Number of	Title of the unit: Safety				ning and
	lectures = 10	Avoidance, Comfort and	d Conven	ience Sys	tems	
Seat belt, regulations, an	utomatic seat belt tight	tener system, collapsible st	eering col	umn, tilta	ble steerir	ng wheel,
air bags, electronic syst	em for activating air	bags, bumper design for sa	afety. EBI	D, ABS, I	Electronic	Braking,
Traction and Stability co	ontrol.					
Collision warning syste	m, causes of rear end	collision, frontal object d	etection,	rear vehic	le object o	detection
system, object detection		-			-	

Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control

Unit – 4	Number of	Title of the unit: Latest Engine Technology Features and 42
	lectures = 11	Volt Systems
Advances in diesel en	gine technology. Direc	ct fuel injection Gasoline engine, Diesel particulate emission control,
Throttling by wire. V	ariable Valve Timing	g, Method used to affect variable Valve Timing, Electromagnetic
	J. J	42 VOLT SYSTEM: Need, benefits, potentials and challenges,
Technology Implicati	ons for the Automotive	e Industry, Technological revolution that will occur as a result of the
adoption of 42-volt sy	vstems.	
12. Brief Description	n of self-learning / E-	learning component
The students will be e	encouraged to learn usi	ing the SGT E-Learning portal and choose the relevant lectures
delivered by subject e	experts of SGT University	sitv.
The link to the E-Leas	rning portal.	
https://sgtlms.org	rning portal. ts in the respective fiel	
https://sgtlms.org	ts in the respective fiel	
https://sgtlms.org Journal papers; Paten 13. Books Recomme	ts in the respective fiel	
https://sgtlms.org Journal papers; Paten 13. Books Recomme Text Book	ts in the respective fiel	
https://sgtlms.org Journal papers; Paten 13. Books Recomme Text Book i) Advanced Ve	ts in the respective fiel	ld. / Heinz Heisler-SAE International Publication, Butterworth-
https://sgtlms.org Journal papers; Paten 13. Books Recomme Text Book i) Advanced Ve Heinemann, 2	ts in the respective fiel	ld. / Heinz Heisler-SAE International Publication, Butterworth-
https://sgtlms.org Journal papers; Patem 13. Books Recomme Text Book i) Advanced Ve Heinemann, 2 Reference Books	ts in the respective fiel ended chicle Technologies by 2 nd Edition, 2002, ISB1	ld. / Heinz Heisler-SAE International Publication, Butterworth-
https://sgtlms.org Journal papers; Paten 13. Books Recomme Text Book i) Advanced Ve Heinemann, 2 Reference Books i) Electric and H	ts in the respective fiel ended chicle Technologies by 2 nd Edition, 2002, ISB1	ld. / Heinz Heisler-SAE International Publication, Butterworth- N: 0750651318. es by Ronald K. Jurgen - SAE International Publication with a
https://sgtlms.org Journal papers; Patem 13. Books Recomme Text Book i) Advanced Ve Heinemann, 2 Reference Books i) Electric and H Product Code	ts in the respective fiel ended chicle Technologies by 2 nd Edition, 2002, ISBN Hybrid Electric vehicle e of PT-85, 2002, ISBN	ld. / Heinz Heisler-SAE International Publication, Butterworth- N: 0750651318. es by Ronald K. Jurgen - SAE International Publication with a

1. Name of the Depar	tment- Mechanical E	Ingineering				
2. Course Name	Maintenance	L	Т	Р		
	Engineering					
3. Course Code		3	0	0		
4. Type of Course (use	e tick mark)	Core ()	• PE (✓)	OE ()		
5. Pre-requisite (if		6. Frequency (use	Even () Odd	Either Every		
any)		tick marks)		Sem () Sem ()		
	ectures, Tutorials, Pi	ractical (assuming 14 wee		0 0		
Lectures = 42		Tutorials = 0	Practical = 0	,		
8. Course Description	l					
-		nance categories Comparat	ive merits of each c	ategory. Preventive		
maintenance, maintenance schedules, repair cycle and Principles and methods of lubrication with TPM.						
9. Learning objectives	· ·	*				
0 0						
Management.	*	••	•			
ii) To enable the students, apply mathematical, computational and communication skills to learn full cost						
analysis for main	ntenance a system.					
iii) To introduce stu	dents' concept of Con	dition Monitoring, Cost co	omparison with and	without CM.		
iv) To introduce students' concept of key features of Industrial and Total Quality Management.						
10. Course Outcomes (COs): On successful completion of this course, the student will be able to:						
i) Define and meas	sure various Basic Prin	nciples of maintenance plan	nning.			
ii) Perform full cos	t analysis for mainten	ance a system.				
iii) Apply the conce	pt of Condition Monit	toring Cost comparison wit	h and without CM			
	•	C				
IV) Explain key leat	ures of industrial and	Total Quality Managemen	ι.			
11. Unit wise detailed o	content					
Unit-1	Number of	Title of the unit: Princip	oles and practices o	of maintenance		
	lectures = 11	planning				
Basic Principles of ma		Objectives and principle	s of planned main	tenance activity –		
-	* *	e systems – Reliability and	-	-		
and MWT – Factors of a	vailability – Maintena	nce organization – Mainte	nance economics.			
Unit – 2	Number of	Title of the unit: Mainte	enance policies –pr	eventive		
	lectures = 10	maintenance				
Maintenance categories	- Comparative mer	rits of each category - l	Preventive mainten	ance, maintenance		
schedules, repair cycle -	Principles and method	ds of lubrication – TPM.				
Unit – 3	Number of	Title of the unit: Condition monitoring				
	lectures = 10					
Condition Monitoring –	Cost comparison with	and without CM - On-load	d testing and offload	l testing – Methods		
		ve tapes – Pistol thermome	eters – wear-debris a	inalysis		
Unit – 4	Number of	Title of the unit: Repair	ir methods for bas	sic machine		
	lectures = 11	elements and for materi	0 1 1			
		gears, lead screws and bea				
-	-	ethods – Sequential fault	-			
		order systems -Use of con	nputers in maintenai	nce.		
12. Brief Description of	f self-learning / E-lea	rning component				

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) "Maintenance Engineering Hand Book" by L T Higgins and L C Marrow, ISBN-13:978-81785749136

Reference Books:

i) "Maintenance Engineering and Management" by Venkataraman (2006) S Chand; 2nd Revised Edition 2006 edition ISBN-13: 978-8121917465

1.	Name of t	he Department- Me	echar	nical Engineeri	ng			
2.	Course	Operation		L	Т		P	
	Name	Research						
3.	Course			3	0		0	
	Code							
4.	Type of C	ourse (use tick		Core ()	PE (✔	´)	OE ()	
	mark)							
5.	Pre-	Industrial	6.	Frequency	Even	Odd (🗸)	Either Sem	Every Sem
	requisite	Engineering		(use tick	0		0	0
	(if any)			marks)				
7.	7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
	Lectures = 42 Tutorials = 0 Practical = 0							
8.	Course De	escription			•			

Operation research is having many powerful tools to optimize the real-life problems. The study of this subject will give knowledge to the students regarding transportation and inventory related problems. This also describes the method of sequencing of jobs through different number of machines. Focus is also given to most common problems of waiting of either job/machines/peoples. Emphasis is given to decision models and replacement problems. So, the study of this subject will develop the capability among students to solve effectively many problems arising during their career.

9. Learning objectives:

- i) To provide students the knowledge of Linear model.
- **ii**) To enable the students, apply mathematical, computational and communication skills to learn Sequencing and Networks needed for the practical utility of Operations Research.
- iii) To introduce students concept of inventory model in Operations Research.
- iv) To introduce students concept of Queuing Models and decision models

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Apply the concept of Linear model to solve various transportation problems.
- ii) Apply the concept of Sequencing and Networks to optimize the production
- iii) Apply the concept of inventory model to maximize the profit.
- iv) Apply the concept of Queuing Models and decision models to forecast the demand in the industry.

11. Unit wise detailed content

Unit-1	Number of	Title of the unit: Linear Models		
	lectures = 10			

Introduction to Operations Research – Linear Programming - Mathematical Formulation – Graphical method – Simplex method – Duality two phase simplex method – Transportation problems – Northwest Corner method – Vogel's Approximation method – MODI method – Transshipment problems - Assignment problems – Applications Introduction to dynamic programming and nonlinear programming- Goal programming.

Unit – 2	Number of	umber of Title of the unit: Sequencing and Networks		
	lectures = 10			
Sequencing –Problem with N jobs and 2 machines using Johnson's method, Problems with N jobs - 3				
machines and 'M' machines using modified Johnson's method.				
Network models – Basic Concepts – Construction of Networks – Project Network – CPM and PERT - Critical				
Path Schoduling Craching of Natural				

Tath beneduling of retwork.			
Unit – 3	Number of	Title of the unit: Inventory Models	
	lectures = 10		

Inventory models – Various Costs and Concepts–EOQ–Deterministic inventory models – Production models – Stochastic Inventory models – Buffer stock.

Unit – 4	Number of	Title of the unit: Queuing Models and decision models				
	lectures = 12					

Queuing models – Poisson arrivals and Exponential service times – Single channel models and Multi channel models. Simulation – Basic concepts – Advantages and Disadvantages – Random number generation – Monte-Carlo Simulation models. Decision models – Game theory – Two person zero sum game – Graphic solution - Property of dominance – Algebraic solution. Replacement models, Items that deteriorate with time - When money value changes – Items that fail completely – Individual replacement and Group replacement.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13.	Books	Recommended

Text Book

i)	DS GUPTA	,PK HIRA(2015),	Operation Research,	S.CHAND	PUBLISHER;	2011	edition
	(2015) ISBN- 2	10: 121212184 ISBN	N-13: 978-1212121844,	ISBN: 978-	8-120- 30162-7.		

Reference Books

- i) Hamdy Taha, (2008), Operations Research-An Introduction, 8th Edition, Pearson Education, ISBN: 978-8-131-71104-0.
- R. Panneerselvan (2006), Operation Research, 2nd Edition, Prentice Hall of India Pvt Ltd ISBN: 978-8-120-31743-7.
- iii) J. K. Sharma (2013), Operation Research, 5th Edition, Macmillan Publications, ISBN: 978-9-350-59336-3.
- iv) Kanti Swarup, P.K. Gupta and Manmohan Lal (2010), Operations Research, 15th Edition, S. Chand & Sons, ISBN: 978- 8-180-54771-3.

1.	Name of the	he Department- Mechani	ical Engineering					
2.	Course	Instrumentation and	L	T P			Р	
	Name	Control Engineering						
3.	Course		3		0		0	
	Code							
4.	Type of C	ourse (use tick mark)	Core ()	PE (✓)	OE ()	OE ()	
5.	Pre-	NIL	6. Frequency	Even	Odd (✔)	Either Sem	Every	
	requisite		(use tick	0		0	Sem ()	
	(if any)		marks)					
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)								
	Lectures =		Tutorials = 0	Practi	cal = 0			
	Course De	-						
	5	f this course is to present s	e					
	-	ystem design. This course	-	-		-		
	e e	echniques from transform	• •	ciple of class	sical physic	s based upon v	which	
		nents and sensors are built						
9.	Learning	-						
		oduce a variety of sensors		•				
		ll a fundamental understar	-				-	
	relate	to temperature, pressure,			-			
		ble students, apply control		-		control system	s found in	
		manufacturing, processin		environments	3.			
		, formulate, and solve eng	* *					
		comes (COs): On comple						
		and fundamental elements				•		
		nathematical models of sin		•				
		able to design a control sy	• •	•	by using the	theory of con	trol system	
	-	plementing it with various						
		ily identify, formulate, and	d solve engineering p	problems				
		detailed content			0.7.5			
Uı	nit-1	Number of lectures =	Title of the unit: F	undamental	s of Measu	ring Systems		
~		11						
	_	ts of Mechanical measuring	-			-		
	-	uments – Static and dynan		-	struments -	- Errors in me	asurements	
		o Transducers and Sensors			! T			
U	nit — 2	Number of lectures = 09	Title of the unit: N	leasuring D	evices - I			
		f vibrations – Acceleromet			-	-		
	-	bi-metallic thermometer, t	-	hermistor, py	rometer – N	Measurement of	of flow- hot	
		er – magnetic flow meter -						
Uı	nit — 3	Number of lectures = 09	Title of the unit: N	leasuring D	evices - II			
Mea	surement of	f displacement – Measurei	ment of Force – Prov	ing Ring, Str	ain gauge, I	Load cells- M	easurement	
				C C.				
	of torque – Measurement of Speed – Case study assignments.Unit – 4Number of lectures =Title of the unit: Fundamentals of Control System &							
of to	nit – 4	Number of lectures =		Fundamen	tals of Co	ontrol System	n &	

Introduction to Control systems – Open and Closed loop systems – servomechanisms. Transfer function: Block diagram reduction algebra, signal flow graphs – Basics of Controllers – Problems.

Time response of First and Second order systems –Frequency domain analysis – Polar and Bode plots – Concept of Stability-Routh-Hurwitz Criterion– Problems. Exposure to applications based on current industrial trends.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Instrumentation And Control Systems Paperback – 1 Jan 2015 by V. Sugumaran, ISBN-10: 9383828501, ISBN-13: 978-9383828500)

Reference Books

- i) Instrumentation and Control Paperback 2011by Patranabis D. (ISBN-10: 8120342461, ISBN-13: 978-8120342460)
- ii) Instrumentation and Process Control Paperback 2019 by D. C. Sikdar. (ISBN-10: 9789382609049, ISBN-13: 978-9382609049)
- iii) J.P. Holman (2004), Experimental Methods for Engineers, Tata McGraw-Hill (ISBN-10: 0070586748, ISBN-13: 978-0070586741)
- iv) I.J. Nagrath and M. Gopal (1999), Control Systems Engineering, New Age Int. Pub (ISBN-10: 9789386070111, ISBN-13: 978-9386070111)

1. Name of the D	1. Name of the Department- Mechanical Engineering					
2. Course Name	Nano-Technology	L		T P		Р
	and Surface					
	Engineering					
3. Course Code		3		0		0
4. Type of Course (use tick mark)		Core ()	PE (✓)		OE ()	
5. Prerequisite	Materials	6. Frequency (use	Even	Odd (✔)	Either	Every Sem
(if any)	Engineering and	tick marks)	0		Sem	0
	Technology				0	
7. Total Number	7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)					
Lectures =42		Tutorials = 0	Practi	cal = 0		
8. Course Description						

Surface engineering is a sub-discipline of Materials Science and Materials Engineering which deals with the surface of a solid and its modifications. The primary goal of Surface Engineering of nanomaterials is to modify the properties of surface to improve its electrical and thermal properties, and to improve the compatibility of nanomaterials with some matrix when they are used as reinforcing fillers in composites for high performance applications. The course should give a basic introduction to chemical and physical principles in the synthesis of inorganic nanostructured materials. In addition, basic principles of finite size effects will be covered. The course will also cover different methods for synthesis and characterization of different nanostructures and nanostructured bulk materials.

9. Learning objectives:

- i) To understand the basic concepts of surface engineering
- ii) To understand the basic concepts of Nano-coating.
- iii) To enhance the knowledge of Nano material.
- iv) To allowing students to get familiarized with Microencapsulation

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Use of surface engineering and Nanomaterials for various industrial applications.
- ii) To understand the basic concepts of Surface Engineering of Nano materials
- **iii**) Qualitatively describe how the nanoparticle size can affect the morphology, crystal structure, reactivity, and electrical properties.
- iv) Describe Microencapsulation and their application in industry

11. Unit wise detailed content	
--------------------------------	--

Unit-1	Number of lectures	Title of the unit: Introduction to Surface Engineering
	= 10	

Tribology & its classification, Friction tribology, Wear & corrosion, Lubrication, Effect of tribology on surface of nanomaterials. Conventional surface engineering, Types of surface modifications, Physical modifications, Chemical modifications, Applications of surface engineering towards nanomaterials.

Unit – 2	Number of lectures	Title of the unit: Nano coatings
	= 10	

Deposition and surface modification methods, Physical vapor deposition, Chemical vapor deposition, Advanced surface, modification practices, Advantages of deposition for surface modification.

Synthesis, processing and characterization of nano-structured coatings, Functional coatings, Advanced coating practices, Characterization of nano-coatings, Applications of nano-coatings.

Unit – 3	Number of lectures	Title of the unit: Surface Engineering of Nano materials
	= 12	

Need of advanced methods for surface and coating testing's, Size dependency in nanostructures of nanocoatings, Size effect in electrochemical properties of nanostructured coatings, Size effect in mechanical properties of nanostructured coatings, Size effect in physical and other properties of nanostructured coatings. Thin films for surface engineering of nanomaterials, Sputtering techniques, Evaporation processes, Thin film deposition through gas phase techniques, Liquid phase techniques.

Unit – 4	Number of lectures	Title of the unit: Microencapsulation
	= 10	

Processes, Microencapsulation: Kinetics of release, Plating of nanocomposite coatings, Advantages of microencapsulation over other conventional methods. Current trends in surface modification of nanomaterials, Modified Nanomaterials: In-use for consumer products, Main problems in synthesis of modified nanomaterials

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

 i) Jamal Takadou, Nanomaterials and Surface Engineering, Edited by m, John Wiley & Sons, Inc, 2019, USA.ISBN: 978-9814774598

Reference Books:

- i) Bharat Bhusan ,Introduction to Tribology , John Wiley & Sons, USA.ISBN: 978-111994453,2013,
- Mahmood Aliofkhazrae ,Nanocoatings: Size Effect in Nanostructured Films , Springer-Verlag, USA.2021,ISBN: 978-0444632371

1.	1. Name of the Department- Mechanical Engineering						
2.	Course	Robot Operating	L		Т		Р
	Name	Systems					
3.	Course		3		0		0
	Code						
4.	Type of Cour	se (use tick mark)	Core ()	PE (✓)	OE ()	
5.	Prerequisite	Materials	6. Frequency (use	Even	Odd (✔)	Either	Every Sem
	(if any)	Engineering and	tick marks)	0		Sem	0
		Technology				0	
7.	Total Number	r of Lectures, Tutorials,	, Practical (assuming 1	4 weeks	of one sem	ester)	
Leo	ctures =42		Tutorials = 0	Practi	cal = 0		
8.	Course Descr	iption					
The	e main aim of thi	is course is to introduce th	ne Robot Operating syste	m. This	course gives	s a brief u	nderstanding
of t	he UNIX, archit	tecture of operating syste	m, computation graph le	vel, det	ougging and	Visualiza	ation. To give
a pi	ractical exposure	e various case studies wil	ll be introduced.				
9.	Learning obj	ectives:					
	i) Introdu	ice the basics of Robot O	perating Systems.				
	ii) Unders	stand the Architecture of	Operating System.				
	iii) Provide	e knowledge on the hard	ware interfacing aspects.				
	iv) Unders	stand the applications of l	ROS in real world comp	lex appl	ications		
10.	Course Outc	omes (COs): On comple	tion of this course, the s	tudents	will be able	to	
	i) Descri	be the need for ROS and	its significance. Summa	rize the	Linux comm	nands use	ed in
	robotic	s.					
	ii) Discus	s about the concepts behi	ind navigation through f	ile syste	m.		
	iii) Explain	n the concepts of Node de	ebugging				
	iv) Analyz	te the issues in hardware	interfacing and discuss a	about th	e applicatior	ns of ROS	5
11.	Unit wise det	ailed content					
Un	it-1	Number of lectures	Title of the unit: Intro	oductio	n to ROS ar	nd UNIX	
		= 10					
Intr	roduction -The	ROS Equation - History	/ - distributions -differe	ence fro	m other me	ta-operat	ing systems-
ser	vices - ROS frar	nework – operating syste	em – releases.				
UN	IX commands -	file system – redirection	of input and output - Fil	e systen	n security - (Changing	access rights
— p:	rocess command	ds – compiling, building a	and running commands	– handli	ng variables		
Un	it – 2	Number of lectures	Title of the unit: Arc	hitectu	re of Opera	ting Syst	em and
		= 10	Computation Graph	Level			

File system - packages – stacks – messages – services – catkin workspace – working with catkin workspace – working with ROS navigation and listing commands.

Navigation through file system -Understanding of Nodes – topics – services – messages – bags – master – parameter server.

Unit – 3	Number of lectures	Title of the unit: Debugging and Visualization
	= 12	

Debugging of Nodes – topics – services – messages – bags – master – parameter – visualization using Gazebo – Rviz – URDF modeling – Xacro – launch files. Hardware Interface: Sensor Interfacing – Sensor Drivers for ROS – Actuator Interfacing – Motor Drivers for ROS.

Unit – 4	Number of lectures	Title of the unit: Case Studies: Using ROS in Real World
	= 10	Applications

 $Navigation\ stack-creating\ transforms\ -odometer\ -\ imu\ -\ laser\ scan\ -\ base\ controller\ -\ robot\ configuration\ -\ laser\ scan\ -\ base\ controller\ -\ robot\ configuration\ -\ laser\ scan\ -\ base\ controller\ -\ robot\ configuration\ -\ robot\ configuration\$

cost map – base local planner – global planner – localization – sending goals – TurtleBot – the low cost mobile robot.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Books

i) Lentin Joseph, "Robot Operating Systems (ROS) for Absolute Beginners, Apress, 2018 2.

 ii) Aaron Martinez, Enrique Fernández, "Learning ROS for Robotics Programming", Packt Publishing Ltd. 2013

Reference Books:

- i) Jason M O'Kane, "A Gentle Introduction to ROS", CreateSpace, 2013.
- ii) Anis Koubaa, "Robot Operating System (ROS) The Complete Reference (Vol.3), Springer, 2018.
- iii) Kumar Bipin, "Robot Operating System Cookbook", Packt Publishing, 2018.
- iv) Wyatt Newman, "A Systematic Approach to learning Robot Programming with ROS", CRC Press, 2017.
- v) Patrick Gabriel, "ROS by Example: A do it yourself guide to Robot Operating System", Lulu, 2012

1. Name of the Department- Mechanical Engineering								
2. Course Name	Modelling and	L	Т]	P			
	Simulation of							
	EHV							
3. Course Code		3	0		0			
4. Type of Course (us	e tick mark)	Core ()	PE (✓)	OE ()				
5. Pre-requisite (if	Introduction to	6. Frequency (use	Even () Odd	Either	Every			
any)	Electric and	tick marks)	(✔)	Sem ()	Sem ()			
	Hybrid Vehicles							
7. Total Number of L	7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures = 42		Tutorials = 0	Practical = 0					
8. Course Description	l							
This course introduces the	he fundamental conce	pts, principles, analysis and	l design of hybr	id and electric	vehicles			
using the Modelling and	Simulation. The mate	erial for this course will be	prepared in suc	ch a manner tl	hat it will			
be useful for graduate st	udents, teachers, pract	itioners and final year und	ergraduate stude	ents.				
9. Learning objective	5:							
i) To know the	e basics of Modelling	in performance parameters						
ii) Learn about	the Modelling of Batt	teries						
iii) To know the	e Drivetrain characteri	stics using Modelling of it.						
iv) Understand	the concept of Energy	Management.						
	· ·	completion of this course,	the student will	be able to				
		le performance parameters						
	ry electric vehicles.	te periormanee parameters	•					
	e drive train characteri	stics						
,	oncepts of energy man							
11. Unit wise detailed		ingement system.						
Unit-1 Number of Title of the unit: Modelling in Performance Parameter								
	lectures = 10		8					
Modelling Vehicle Acce	leration - Acceleration	performance parameters, r	nodelling the ac	celeration of a	n electric			
scooter, modelling the a			0					
Unit – 2	Number of	Title of the unit: Model	ing of Electric	Vehicles Bat	terv			
	lectures = 12		8		5			
Electric Vehicle Modell		Rolling resistance force, A	erodynamic dra	ng, Hill climbi	ng force.			
		lling Electric Vehicle Rang		-	-			
		ange modelling, Range m	•••	•	0			
modelling of hybrid elec	-	6, 6, 6,	6		.,			
Unit – 3	Number of	Title of the unit: Drivet	rain Character	istics				
	lectures = 10							
Modelling and Characte		wertrains Components- ICl	E Performance (Characteristics	Electric			
-		ery Performance, Charact						
		teristics-Driving Cycles M						
Hybrid Electric Vehicles	-		ocoming and A	inaryono or Lite				
Unit – 4								
	lectures = 10		magement					
Analysis of Floatria an		l icles - Simplified Handling	Models Energy	/Power Allos	ation and			
	•							
Control Strategies	Management - Power/Energy Management Controllers - RuleBased Control Strategies - Optimization-Based Control Strategies							

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Book	13. Books Recommended					
Text Boo	k					
i)	James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd,					
	2003.					
Referenc	e Books					
i)	Amir Khajepour, Saber Fallah and AvestaGoodarzi, "Electric and Hybrid VehiclesTechnologies,					
	Modelling and Control: A Mechatronic Approach", John Wiley & Sons Ltd, 2014.					
ii)	Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles_					
	Fundamentals, Theory, and Design, Second Edition", CRC Press, 2010.					

Department Electives-X

1.	Name of	the Department- Me	chanica	l Engineerin	g			
2.	Course	Advanced He	at	L	Т		Р	
	Name	Transfer						
3.	Course			3	0		0	
	Code							
4.	Type of C	Course (use tick mark	x)	Core ()	PE (•	^)	OE ()	
5.	Pre-	Heat and Ma	iss 6.	Frequenc	Even	Odd ()	Either	Every
	requisit	Transfer		y (use tick	(✔)		Sem ()	Sem ()
	e (if			marks)				
	any)							
7.	Total Nur	nber of Lectures, Tu	torials,	Practical (as	suming 14	weeks of	one semeste	er)

7. Total Number of Lectures, 1	utorials, Practical (as	suming 14 weeks of one	semester
Lectures = 42	Tutorials = 0	Practical = 0	

8. Course Description

An introductory course in heat and mass transfer covering conduction, convection and radiation heat transfer, principals of heat exchanger and mass transfer. Heat transfer and mass transfer are kinetic processes that may occur and be studied separately or jointly. Studying them apart is simpler, but both processes are modelled by similar mathematical equations in the case of diffusion and convection (there is no mass-transfer similarity to heat radiation), and it is thus more efficient to consider them jointly. Besides, heat and mass transfer must be jointly considered in some cases like evaporative cooling and ablation.

9. Learning objectives:

- i) To comprehend and evaluate various modes of heat and mass transfer.
- ii) To design fin enhanced systems, evaporators, condensers and heat exchangers.
- iii) To understand boundary layer theory, condensation and boiling.

iv) To determine effectiveness of heat exchangers using LMTD and NTU.

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Apply basic principles of fluid mechanics, thermodynamics, heat transfer for designing heat and mass transfer systems.
- ii) Model heat, mass and momentum transport systems and develop predictive correlation.
- iii) Assess and evaluate various designs for heat and mass transfer and optimize the solution.
- iv) Apply the basic principles of heat exchanger applications.

11. Unit wise detailed content

Unit-1	Number	of	Title of the unit: Conduction
	lectures = 9		

Introduction

Reviews of basic laws of Conduction, Convection and Radiation

Steady State Heat Conduction

Thermal insulation problem, Extended surfaces- Fins with uniform cross-sectional area, Fins variable cross-sectional area- circumferential, triangular and parabolic shape, Fin effectiveness and efficiency, thermal contact resistance. Methods for the solution of the Multi-Dimensional heat conduction problem: Analytical Method, Graphical Method, Electrical Analogy, Numerical Methods, Numerical.

Unit – 2	Number of lectures = 11	Title of the unit: External Flow and Forced Convection
Introduction, E thermal bound & average hea Reynolds analo	ary layer, boundary layer t transfer coefficient, mas ogy, Reynolds-Colburn a	tegral solutions for the flow over flat plate, hydrodynamic & thickness, drag coefficient, mean drag coefficient, The local ss flow through the boundary, Turbulent flow over flat plate, nalogy, Drag & heat transfer in mixed boundary layer, Flow Cross flow over banks of tubes, Numericals.
Unit – 3	Numberoflectures = 11	Title of the unit: Convection and Phase Heat Transfer
Introduction, E differential equ equation, Fann differential equ boundary cond Correlations fo Boelter equation Two Phase Heat	uation and velocity profi ing friction coefficient, H lation, heat transfer coeffi litions, Velocity distributi or turbulent flow in tub on, Sieder and Tate equati at Transfer	Veloped region, Mean velocity, Mean temperature, Governing ile for fully developed laminar tube flow, Hagen-Poiseuille leat transfer for fully developed laminar tube flow: Governing cient for constant wall temperature and constant wall heat flux fon in turbulent flow through pipe, Fluid friction, Convection des: Reynolds Analogy, Reynolds-Colburn analogy, Dittus- tion, Petukhov expression, Numerical.
condensation,	Boiling regimes, Nucleate	e and film boiling, Heat pipe.
Unit – 4	Number of lectures = 11	Title of the unit: Radiation and Heat Exchanger
Use of LMTI evaporative tub Tube Heat Exc of heat exchan Thermal Radia	and selection of heat excha D, Multipass heat excha bular heat exchanger, Eva hanger, Simulation of hea ger size, Numerical. ttion	angers, Some important definitions, Heat Exchanger Analysis: angers, Effectiveness NTU Method, Plate heat exchanger, aporative Effectiveness, Dryout heat flux, Design of Shell and t exchangers, Pressure drop and Pumping power, Optimization Black body concept, gray body radiation, Solar radiations
Radiation betw black enclosure a cavity, Radia	veen surfaces- Shape fact e, Network representation	for and correlations, Radiation exchange between surfaces in , Radiation exchange in gray enclosure, apparent emissivity of n emitting and absorbing media.
The students v		rn using the SGT E-Learning portal and choose the relevan
The link to the H	E-Learning portal.	
	2 20 anim 8 portant	
http://sgtlms.org		

13. Bo	oks Recommended
Tex	t Books:-
i)	R. C. Sachdeva (2005), Fundamentals of Heat and Mass Transfer, New Age International
	(P) Ltd. ISBN: 978-8-122-40076-2.
ii)	P. K. Nag (2005), Heat Transfer, Tata McGraw Hill Publishing Company Limited. ISBN:
	978-0-070-60653-1.
Ref	erence Books:-
i)	J. P. Holman (2005), Heat Transfer, 9th Edition, McGraw-Hill Publishing Company
	Limited. ISBN: 978-0-070-29618-3.
ii)	Dewitt Lavine, Bergmann and Incropera (2010), Fundamentals of Heat and Mass Transfer,
	6th Edition, John Wiley & Sons, ISBN: 978-8-126-52764-9.
iii)	M. Necat Ozisik, Helcio R.B. Orlande (2021), Inverse Heat Transfer: Fundamentals and
	Applications, 2 nd Edition, CRC Press, Taylor & Francis, ISBN 9780367820671.
iv)	Abram S. Dorfman, (2010), Conjugate Problems in Convective Heat Transfer, 1st Edition, CRC
	Press, Taylor & Francis, ISBN 9781138372719.
-	S. Mostafa Ghiaasiaan, (2018), Convective Heat and Mass Transfer, 2 nd Edition, CRC Press,
	Taylor & Francis, ISBN 9780815361411.

1.							
2.	Course	Modeling and	L		Т		Р
	Name	Simulation of					
		Manufacturing					
		System					
3.	Course		3		0		0
	Code						
4.	Type of Co	ourse (use tick mark)	Core ()	PE (✓)	OE ()	
5.	Pre-	Computer Aided	6. Frequency	Even ()	Odd (✔)	Either Sem	Every Sem
	requisite	Machine Design	(use tick			0	0
	(if any)		marks)				
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semi					emester)		
	Lectures =	42	Tutorials = 0	Practi	ical = 0		
0	Course Do	a anim ti an	•	•			

8. Course Description

The objective of this course is to give a sound knowledge of the fundamental aspects of system simulation, which is used in the analysis of complex system and finds applications in a wide range of real-life situations. Modeling and Simulation of Manufacturing Systems course is concerned with the concepts of system, system modeling and simulation, has been expanded to include the details of types of models and simulation software. This course covers the mathematical and statistical models. This course provides the knowledge of random number generation and inverse transform techniques. This course also discusses the analysis of simulation data and application of simulation system in manufacturing and material handling systems

9. Learning objectives:

- i) To learn about discrete event simulation basics.
- **ii**) To introduce modeling, simulation and optimization as it applies to the study and analysis of manufacturing systems for decision support.
- iii) To expose with a wide range of applications for simulation methods and models and to integrate them with their introduction to operations management.
- iv) To familiarize students with the process of analyzing different types of simulation data.

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Develop the practical skills necessary to design, implement and analyze discrete-event simulation systems.
- **ii)** Cover the basic theory underlying discrete-event simulation methodologies in order to enable a critical understanding of simulation output in managerial environments.
- **iii**) Get comfortable in applying and analyzing the process of operations management. Build the foundations necessary to quickly adapt for future advances in simulation technology.
- iv) Build the foundations necessary to quickly adapt for future advances in simulation technology.

it) Build the foundations necessary to querky adapt for future advances in simulation technology.					
11. Unit wise detailed content					
Unit-1	Number of lectures Title of the unit: Introduction to System Simulation				
	= 11				
Introduction to	Introduction to system simulation – Applications – Discrete and Continuous simulation – Simulation models –				
Simulation pro	ocedure-Simulation Exa	mples – General Principles -Simulation software.			
Unit – 2	Number of lectures	Title of the unit: Mathematical and Statistical Models &			
	= 10	Applications			
Review of basic probability and Statistics - Statistical models in simulation - Selecting input probability					
distributions. Simulation of Manufacturing and Material Handling systems – Simulation of Computer Systems					
– Simulation o	of Computer Networks				

Unit – 3	Number of l	lectures Title of the unit: Random Numbers				
	= 10					
Random	number generation	n-Testing of Random numbers – Techniques for generating random numbers				
Random	Variate Generation	ion– Inverse transform techniques-Acceptance-Rejection techniques- Specia				
properties	s.					
Unit – 4	Number of l	lectures Title of the unit: Analysis of Simulation Data				
	= 11					
Input mod	deling – Data colle	ection - Identifying the distribution with data- Parameter estimation - Goodness o				
fit tests –	- Fitting a non-stati	ionery Poisson's process- Selecting input models without data-Multi Variate and				
Time Seri	ies Input Models- N	Model Building – Verification, Validation and Calibration of Simulation Models -				
Output an	nalysis – Comparis	son and Evaluation of Alternative System designs. Exposure to applications based				
on curren	t industrial trends.					
12. Brief	Description of self	f-learning / E-learning component				
The studen	The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures					
delivered by subject experts of SGT University.						
delivered b	-					
	-	of SGT University.				
	by subject experts of the E-Learning point	of SGT University.				
The link to https://sgtlr	by subject experts of the E-Learning point	of SGT University.				
The link to https://sgtlr Journal pa	by subject experts of the E-Learning por ms.org	of SGT University.				
The link to https://sgtlr Journal pa	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended	of SGT University.				
The link to https://sgtlr Journal pa 13. Books Text Book	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended	of SGT University.				
The link to https://sgtlr Journal pa 13. Books Text Book i) Ste	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended :: ephen Jerry banks, J	of SGT University. ortal. e respective field.				
The link to https://sgtlr Journal pa 13. Books Text Book i) Ste	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended :: ephen Jerry banks, J nulation, 4th Editio	of SGT University. ortal. e respective field. John S Carson, Barry L Nelson and David M Nicol (2006), Discrete Event Systen				
The link to https://sgtlr Journal pa 13. Books Text Book i) Ste Sin Reference	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended :: ephen Jerry banks, J nulation, 4th Editio Books:	of SGT University. ortal. e respective field. John S Carson, Barry L Nelson and David M Nicol (2006), Discrete Event Systen				
The link to https://sgtlr Journal pa 13. Books Text Book i) Ste Sin Refererce i) Ma	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended : ephen Jerry banks, J nulation, 4th Editio Books: anufacturing System	of SGT University. ortal. e respective field. John S Carson, Barry L Nelson and David M Nicol (2006), Discrete Event Systen on, Pearson Education Asia. ISBN: 978-8-177-58591-9				
The link to https://sgtlr Journal pa 13. Books Text Book i) Ste Sin Refererce i) Ma Fel	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended : ephen Jerry banks, J nulation, 4th Editio Books: anufacturing System Idman (ISBN-13: 9	of SGT University. ortal. e respective field. John S Carson, Barry L Nelson and David M Nicol (2006), Discrete Event Systen on, Pearson Education Asia. ISBN: 978-8-177-58591-9 ms Modeling and Analysis 2nd ed. 2011 Edition by Guy L. Curry, Richard M.				
The link to https://sgtlr Journal pa 13. B⊍ks Text B∪ks i) Ste Sin Refererce i) Ma Fel ii) Av	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended : ephen Jerry banks, J nulation, 4th Editio Books: anufacturing System Idman (ISBN-13: 9	of SGT University. prtal. e respective field. John S Carson, Barry L Nelson and David M Nicol (2006), Discrete Event System on, Pearson Education Asia. ISBN: 978-8-177-58591-9 ms Modeling and Analysis 2nd ed. 2011 Edition by Guy L. Curry, Richard M. 078-3642166174, ISBN-10: 9783642166174) W David Kelton (2000), Simulation Modeling and Analysis, 3rd Edition, McGraw				
The link to https://sgtlr Journal pa 13. B→ks Text B→ks i) Ste Sin Refer= i) Ma Fel i) Av Hil	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended : ephen Jerry banks, J nulation, 4th Editio Books: anufacturing System Idman (ISBN-13: 9 /erill M. Law and W Il. ISBN: 978-0-071	of SGT University. prtal. e respective field. John S Carson, Barry L Nelson and David M Nicol (2006), Discrete Event System on, Pearson Education Asia. ISBN: 978-8-177-58591-9 ms Modeling and Analysis 2nd ed. 2011 Edition by Guy L. Curry, Richard M. 078-3642166174, ISBN-10: 9783642166174) W David Kelton (2000), Simulation Modeling and Analysis, 3rd Edition, McGraw				
The link to https://sgtlr Journal pa 13. B⊍Ks Text B∪Ks i) Ste Sin Refererce i) Ma Fel ii) Av Hil ii) W	by subject experts of the E-Learning por ms.org apers; Patents in the s Recommended :: ephen Jerry banks, J nulation, 4th Editio Books: anufacturing System Idman (ISBN-13: 9 verill M. Law and W II. ISBN: 978-0-071 David Kelton, Ran	of SGT University. prtal. e respective field. John S Carson, Barry L Nelson and David M Nicol (2006), Discrete Event System on, Pearson Education Asia. ISBN: 978-8-177-58591-9 ms Modeling and Analysis 2nd ed. 2011 Edition by Guy L. Curry, Richard M. 078-3642166174, ISBN-10: 9783642166174) W David Kelton (2000), Simulation Modeling and Analysis, 3rd Edition, McGraw 1-16537-2.				

		artment- Mechanical		Т		- I		
. Course N	Name	Gas Dynamics and Jet Propulsion	-			Р		
. Course (Code		3	0	0		0	
Type of	Course (1	ıse tick mark)	Core ()	PE (1	/)	OE ()		
. Pre-requ	isite (if	Engineering	6. Frequency (use	Even ()	Odd	Either	Every	
any)		Thermodynamics	tick marks)		(🖌)	Sem ()	Sem ()	
. Total Nu	mber of	Lectures, Tutorials, I	Practical (assuming 14	weeks of o	one semes	ster)		
Lectures = 4	42		Tutorials = 0	Prac	tical = 0			
. Course I	Descriptio)n						
The principle	es of iet r	propulsion are of prime	significance in designi	ng and con	structing	aircraft engi	nes The	
· ·		• •	ng of thermodynamics a	0	•	•		
-			the engineering analys			-		
-			es, combustion chamber	•		ine engines		
- -	-	-		. 1				
. Learning				-				
i)		• •	of fuels, their composition					
ii)	-	-	applications of compre	essible flow	vs and th	ne fundame	ntals of j	
•••	· ·	ion systems.				~		
iii)		-	ems in one-dimensional	-	pressible	e flow.		
iv)		*	ensional compressible					
		· · · ·	n of this course, the stu			1 1 1 /	4	
i)		-	of major elements i	n a jet er	igine and	i calculate	the overa	
••)	-	nance of a jet engine.	1	1. (
ii)			dynamics for applicati	ons related	to comp	pressible flo	ows and jo	
	propuls		-hustion in Tota					
iii) i		the knowledge of con		nulsion the	omiaa			
iv) 1. Unit wise		÷ ;	engines and aircraft pro	puision me	ones.			
Unit-1		Number of	Title of the unit: (Gas Dynan	nics			
		lectures = 10		-				
Conserva	tion laws	for mass - Momentum	and energy in steady f	low - Velo	city of sou	und - Bulk n	nodulus of	
elasticity	- Coeffic	cient of Compressibility	y - Stagnation state - Ci	ritical state	- Various	regions of f	low -	
Physical	significar	nce of Mach number –	Crocco Number - Chara	acteristic M	lach numl	ber - Critical	l Mach	
number -	Mach co	ne - Von – Karma's ru	les for supersonic flow	– Differenc	es betwe	en Incompre	essible and	
Compress	sible flow	vs. Properties of atmosp	phere - Effect of Mach	number on	compress	ibility: T-S	and H-S	
	showing	Nozzle and Diff user p	process.					
Unit – 2		Number of	Title of the unit: I	sentropic	Flow			
		lectures = 10						
Isentronio	c flow the	ough a constant area o	luct – Absence of any	of the facto	re which	can trigger	a changa i	
isentioph		ough a constant area (act moschee of any	of the facto	ns which	can ungger	a change	
-		-	at transfer - Friction and				-	

number - Impulse function - Mass flow rate through nozzles and diff users. Phenomenon of choking -
subsonic and supersonic designs - Pressure values for nozzles - Diffusers.

Unit – 3	Number of	Title of the unit: Flow Through Constant Area Duct and
	lectures = 12	Combustion

Fanno flow - Fanno curves - Equation and its solution - Variation of flow properties with duct length - Applications. Isothermal flow with friction – Variation of flow properties – Applications Rayleigh flow - Rayleigh flow equation - Rayleigh line – Variation of flow properties - Maximum heat transfer applications. on Isothermal flow with heat transfer and friction - Basic formulation– Elementary treatment only. Flow with normal shock waves - Governing equations - Prandtl–Meyer equation - Impossibility of rarefaction

shock – Mach number downstream of shock - Property variation across shock - Strength of shock wave entropy change. Characteristics of flow through a C-D nozzle at various back pressures. Normal shocks in Fanno and Rayligh flow. Flow with oblique shock waves (Qualitative treatment)

Unit – 4	Number of	Title of the unit: Jet Propulsion
	lectures = 10	

Air craft propulsion – Types of jet engines - Energy flow through jet engines - Thrust - Thrust power and Propulsive efficiency - Turbojet components - Diff user compressor - Combustion chamber - Turbines -Exhaust system - Performance of jet engines – Thrust augmentation - Pulse jet and Ram jet engines. Rocket propulsion – Rocket engines - Basic theory of equation – Thrust effective jet velocity - Specific impulse -Rocket engine performance - Solid and Liquid propellant rockets - Comparison of various propulsion systems - Principle and Working of Helicopter.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Stephen Turns, (2011), an Introduction to Combustion: Concepts and Applications, McGraw Hill. **Reference Books**

i) John B. Heywood – Internal Combustion Engine, McGraw Hill.

ii) Mishra, D. P, (2000), Fundamentals of Combustion, Prentice Hall of India.

1.Name of the Departme	8		1		1	
2.Course Name	Industrial Safety Engineering	L	[Г]	Р
3.Course Code		3)	(0
4.Type of Course (use tio	ck mark)	Core ()	PE (✔)		OE ()	
5.Pre-requisite (if any)		6.Frequency (use tick				Every
		marks)	(✓) Sem () S			
7.Total Number of Lectu	ires, Tutorials, Pract	tical (assuming 14 weeks	of one ser	nester)		
Lectures = 42		Tutorials = 0	Practica	$\mathbf{l} = 0$		
8.Course Description						
This course provides stude	ents a brief overview	on Industrial Safety. This i	ncludes u	nderstand	ing the saf	ety
precautions in various ma	nufacturing processes	Also give overview on sa	afety in fir	nishing an	d testing.	
9.Learning objectives:						
i) Possess a mastery	of Health safety and	environment knowledge an	nd safety r	nanageme	ent skills, t	o reach
higher levels in th	eir profession, Safety	v in metal working and woo	od working	g machine	s.	
ii) Design, Establish	, Implement maintain	and continually improve a	in occupat	ion health	and mana	gement
system to improve	-	÷ 1	*			-
• •	•	cidents using root cause an	alysis and	generate	corrective	and
-		and occurrence of such in	-	0		
^	•	using human factors engin		ols so as to	o achieve c	comfort.
• •	•	ee and safe workplace envi	-	10 00 00 00		
10. Course Outcomes (C						
iii) Understanding the	e concept of Safety in e concept of Safety in	s of Machine Guarding Welding and Gas Cutting Finishing, Inspection and	Testing			
Unit-1	Number of	Title of the unit: Safety	in metal y	working	and wood	
	lectures = 10	working machines		, or many t		
General safety rules-turni		nachines-milling, planning	and oring	ling mach	nines_gene	ral safet
principles-safety in the us and care of cutting tools – prevention.	se of sawing machines - preventive maintenan	s-wood working equipmen nce, periodical checks for s	nt's. CNC safe opera	machines tion – asso	-need for ociated ha	selectio
Unit – 2	Number of	Title of the unit: Princip	ples of Ma	achine Gu	larding	
	lectures = 10					
		State (ZMS) – Definition - ine guarding-types-fixed g	-			
	-	d-fixed guard fencing. Se			•	-
boring-milling-grinding-s	haping-sawing-sheari	ng- presses-forge hammer-	-flywheels	-shafts-co	ouplings-go	ears
sprockets wheels and chai	ins-pulleys and belt	s-authorized entry to haz	ardous in	stallation	s-benefits	of goo
guarding systems.						
Unit – 3	Number of	Title of the unit: Safety	in Weldiı	ng and G	as Cutting	ξ
	lectures = 10			5	6	-
Gas welding and oxyge		welding, arc welding a	nd cuttin	g-commo	n hazards	-person:
• ••	e	ons in brazing, soldering a				•
		ed equipment and instrume		-	-	-
serection, care and mallite	munee of the associate	sa squipinent and instituint	- sale	cy in gene	cranon, un	saroution

and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

Unit – 4	Number of	Title of the unit: Safety in Finishing, Inspection and Testing
	lectures = 12	

Safety in grinding-heat treatment operations-electro plating-paint shops-sand and shot blasting-safety in inspection and testing-dynamic balancing- hydro testing -valves- boiler drums and headers- pressure vessels, air leak test- steam testing-safety in radiography- personal monitoring devices-radiation hazards – engineering and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.

12.Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13.Books Recommended

Text Book

i) Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 5th Edition. ISBN: 0939874989

Reference Book

 i) Health and Safety in welding and Allied Processes, welding Institute, UK, High Tech. Publishing Ltd., London, 2002 5th Edition. ISBN: 9781855735385

1. Name of the Depart	ment- Mechanical E	Ingineering							
2. Course Name	Sales &	L]	Г]	P			
	Marketing								
3. Course Code	0	3	()	()			
4. Type of Course (use	e tick mark)	Core ()	PE (✔)		OE ()				
5. Pre-requisite (if		6. Frequency (use	Even ()	Odd	Either	Every			
any)		tick marks)		(✔)	Sem ()	Sem ()			
7. Total Number of Lo	ectures, Tutorials, Pi	ractical (assuming 14 wee	ks of one	semester)				
Lectures = 42Tutorials = 0Practical = 0									
8. Course Description									
This is a course based on practical introduction to marketing and sale management, students improve their ability									
to make effective sales a	and marketing decision	ons, including assessing m	arketing c	pportunit	ies and de	veloping			
marketing strategies and	implementation plans								
9. Learning objectives	:								
i) Develop effectiv	e marketing strategies	s and sales strategies to ach	ieve orgai	nizational	objectives	5.			
ii) Design a strategy	y implementation prog	gram to Developing Sales	Fraining						
iii) To develop pract	tical concept of Princi	ples of Management							
iv) To develop pract	tical concept of Marke	eting Management and Fin	ancial Ma	nagement					
	· •	of this course, the students	s will be a	ble to					
		of Sales Management.							
	ne Developing Sales 7								
	ne concept and Princip		aial Mana	aamaant					
	-	ng Management and Finan		gement					
11. Unit wise detailed c			1.0						
Unit-1	Number of	Title of the unit: Nature	and Sco	pe of Sale	s Manage	ment			
	lectures = 10	1 1.6	6.0.1		(D	<i></i> C			
		bjectives and functions on ning and delivering of sales							
Sales Personnel – Metho			s presentat		annig and	selecting			
	6	1	nin a Sala	- T	~				
Unit – 2	Number of	Title of the unit: Develo	ping Sale	s i rainin	g				
Davalaning Cales Trainin	lectures = 12	uting and Exclusting color.			. Matirua	in a Calaa			
	0 0	uting and Evaluating sales Designing and Adminis		0		0			
	č	sales evaluation programn	•		.				
performances of sales pe		F-8	,r						
Unit – 3	Number of	Title of the unit: Princip	oles of Ma	nagemen	t				
	lectures = 10	-		0					
Introduction, Planning,	Organizing, Staffing,	Motivating and Leading,	Controlli	ng, introd	luction to	business			
-		mer behavior and demand		-					
analysis and price output	-				*				
Unit – 4	Number of	Title of the unit: M	Iarketing	Manag	ement ar	nd			
	lectures = 10	Financial Management							
Product, Pricing Decision	ons, Place, Promotion	n, Types of channels, pro	omotion n	nix, produ	ict innova	tion and			
÷ ÷		istics and supply chain	-		-	<u> </u>			
	-	rds, Journal sizing transact	ions, capi	tal and re	venue, de	precation			
provisions and reverse, c	ompany final account	Ś.							

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Bool	xs Recommended				
Text Book					
i)	Tanner, J; Honeycutt ED; Erffmeyer Robert C.; Sales management: Pearson Education, 2009, ISBN-13: 978-8131727379				
Referen	ce Books				
i)	Dalrymple, D J. Sales Management: Concepts and cases. New York, John Wiley, 1989, ISBN no.045089186				
ii)	Still, R R. & Cundiff; Sales Management, Englewood Cliff, New Jersey, Printice Hall Inc ISBN: 0470452185				

1. Name of the	e Department- Mecl	nanical Engineering				
2. Course Name	Neural Networks and Fuzzy Systems	L	Τ		Р	
3.Course Code		3	0		0	
4.Type of Cou mark)	rse (use tick	Core ()	PE (✓)	OE ()	
5.Pre- requisite (if any)	an of Lastance Trate	6.Frequency (use tick marks)	Even ()	Odd (🗸)	Either Sem ()	Every Sem ()
	er of Lectures, Tuto				one semeste	r)
Lectures =42	•	Tutorials = 0	Practi	cal = 0		
8. Course Des	scription					
Neural versus algorithm. Re theory. Fuzzy 9. Learning o i) Introdu ii) Provide iii) Gain ur iv) To und	ction to neural netwo conventional compu current networks. Se Logic. Neuro-Fuzzy bjectives: ce the fundamentals e an overview of deep nderstanding about the erstand membership	ting. Learning process If-organization Featury system in engineering of Neural Networks a b learning and convolute fundamentals of Fu functions and applica	and its a lutional luzy Log ations.	e MLP NN, Applications. pplications. neural netwo gic and its a	backpropagat ns. Introduct orks. pplications	tion learning
	y the types of neural	1	urse, the	students wi	III DE ADIE IO	
	about the applicatio			1 1 /	1	
	be the concepts of dee re fundamentals of cl				WORKS	
v) Charac	terize the fuzzy mem	bership functions.				
	rize the applications ise detailed content	of fuzzy logic contro	ollers.			
Unit-1	Number of lectures = 10	Title of the unit: I	ntroduc	tion to Neu	ral Network	S
Activation Fun Separability - Applications.	etween Biological an ctions, McCulloch - Hebb Net, Percept	Pitts Neuron, Simple ron, Adaline, Mada	Neural line -	Nets for Pat Architecture	ttern Classific e, algorithm,	cation, Linear and Simple
Unit – 2	Number of lecture				twork Appli	
0 0	orithms for Pattern e and Iterative Auto a k Controllers					

Unit – 3	Number of lectures = 12	Title of the unit: Deep Learning and Convolution
		Neural Networks, Classical and Fuzzy Sets and
		Relations

Evolution of deep learning – Impact of deep learning – Motivation for deep architecture – Applications – Deep Learning in Computer Vision – Convolutional Neural Networks – Popular CNN Architecture – Simple Applications. Properties and Operations on Classical and Fuzzy Sets, Crisp and Fuzzy Relations - Cardinality, Properties and Operations, Composition, Tolerance and Equivalence Relations, Simple Problems.

Unit – 4	Number of lectures = 10	Title	of	the	unit:	Membership	Functions	and
		Appli	cati	ons				

Features of membership function, Standard forms and Boundaries, fuzzification, membership value assignments, Fuzzy to Crisp Conversions, Defuzzification methods, Neural Networks: Case Studies: Inverted Pendulum, CMAC, Robotics, Image compression, and Control systems - Fuzzy Logic: Mobile robot navigation, Autotuning a PID Controller.

12. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing home, 2002

ii) Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 2009.

Reference Books

- i) LaureneFausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 2008.
- ii) Simon Haykin, 'Neural Networks', Pearson Education, 2003.

iii) George.J.Klir, 'Fuzzy Sets and Fuzzy Logic – Theory and Applications', Pearson, 2015.

iv) Rajasekaran, VijayalakshmiPai, "Neural Networks, Fuzzy Systems and Evolutionary Algorithms", PHI Learning, 2017.

v) Shigeo Abe, "Neural Networks and Fuzzy Systems", Springer, 2012.

2. Course Name	Aerospace Materials	L	Т		Р	
3.Course Code		3	0		0	
4.Type of Cou mark)	ırse (use tick	Core ()	PE (✓)		OE ()	
5.Pre- requisite (if any)	MET	6.Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
		itorials, Practical (as	suming	14 weeks of o	one semester)	I
Lectures = 42 8. Course De		Tutorials = 0	Practi	cal = 0		
 i) To entiii) To stu iii) To stu iv) To stu iv) To stu 10. Course Or i) To app ii) To exp iii) To exp iii) To exp 	umerate the mechar dy the importance of dy the role of ferror dy the thermal prop utcomes (COs): Or ply the knowledge a plain the application plain the application	s undergoing this cour nical properties of aero of non-ferrous metals us metals in aerospace perties and the behavior n course completion st about the mechanical to ns of aluminum alloys ns of alloy steel, corro unce of high temperatu	ospace m in aerosp e equipm or of mat udents w oehaviou , ceramic sion and	aterials. bace equipment ent. erials at high vill be able to: r of different es and composi- heat resistant	temperature. aircraft & aerospa sites materials. steel materials.	ce materials.
	vise detailed conte					
Unit-1	Number of lectures = 10	Title of the unit: M				
of Various ty		perties – Yielding, stra esting machines- Not		•	•	Ű
Unit – 2	Number of lectu	ures = 11 Title of t		Non-ferrous	materials in airc	raft
treatments. Ma	agnesium and its a	and identification. Pro lloys: Cast and Wrou atments. Titanium and	perties - ght alloy	vs – Aircraft a	application, featur	es specification,

Unit – 3	Number of lectures = 11	Title of the unit: Ferrous materials in aircraft construction
Steels: Plai	in and low carbon steels, various	low alloy steels, aircraft steel specifications, corrosion and heat
resistant ste	eels, structural applications. Marag	ing Steels: Properties and Applications. Super Alloys: Use - Nickel
base – Cob	balt base – Iron base -Forging and	Casting of Super alloys – Welding, Heat treatment
Unit – 4	Number of lectures = 10	Title of the unit: High Temperature Materials
		Characterization
Classificati	ion, production and characteristics	, Methods and testing, Determination of mechanical and thermal
		res, Application of these materials in Thermal protection systems
of Aerospa	ice vehicles, High temperature mat	terial characterization.
12. Br	rief Description of self-learning /	E-learning component
	by subject experts of SGT Universi	ty.
The link to	the E-Learning portal.	ty.
The link to <u>https://sgtlr</u>	the E-Learning portal.	
The link to https://sgtlr Journal pap	the E-Learning portal.	
The link to https://sgtlr Journal pap	o the E-Learning portal. ms.org pers; Patents in the respective field poks Recommended	
The link to https://sgtlr Journal par 13. Bo Text Book i) Par	o the E-Learning portal. ms.org pers; Patents in the respective field poks Recommended transformed to the following of	
The link to https://sgtlr Journal par 13. Bo Text Book i) Par	o the E-Learning portal. ms.org pers; Patents in the respective field ooks Recommended t ntelakis, S., Tserpes, K. (2020), "F ringer International Publishing, IS	l. Revolutionizing Aircraft Materials and Processes", Germany:
The link to https://sgtlr Journal pap 13. Bo Text Book i) Pan Spi	o the E-Learning portal. ms.org pers; Patents in the respective field ooks Recommended ntelakis, S., Tserpes, K. (2020), "F ringer International Publishing, IS Books	l. Revolutionizing Aircraft Materials and Processes", Germany:
The link to https://sgtlr Journal pap 13. Bo Text Book i) Pan Spr Reference	o the E-Learning portal. ms.org pers; Patents in the respective field ooks Recommended ntelakis, S., Tserpes, K. (2020), "F ringer International Publishing, IS Books	Revolutionizing Aircraft Materials and Processes", Germany: BN: 9783030353469, 303035346X tion to Aerospace Materials", United Kingdom: Elsevier Science,
The link to https://sgtlr Journal pap 13. Bo Text Book i) Pan Spr Reference	o the E-Learning portal. ms.org pers; Patents in the respective field ooks Recommended intelakis, S., Tserpes, K. (2020), "F ringer International Publishing, IS Books Mouritz, A. P. (2012), "Introduct ISBN: 9780857095152, 0857095	Revolutionizing Aircraft Materials and Processes", Germany: BN: 9783030353469, 303035346X tion to Aerospace Materials", United Kingdom: Elsevier Science,
The link to https://sgtlr Journal pap 13. Bo Text Book i) Pan Spr Reference i)	o the E-Learning portal. ms.org pers; Patents in the respective field ooks Recommended intelakis, S., Tserpes, K. (2020), "F ringer International Publishing, IS Books Mouritz, A. P. (2012), "Introduct ISBN: 9780857095152, 0857095	Revolutionizing Aircraft Materials and Processes", Germany: BN: 9783030353469, 303035346X tion to Aerospace Materials", United Kingdom: Elsevier Science, 5153
The link to https://sgtlr Journal pap 13. Bo Text Book i) Pan Spr Reference i)	o the E-Learning portal. ms.org pers; Patents in the respective field ooks Recommended intelakis, S., Tserpes, K. (2020), "F ringer International Publishing, IS Books Mouritz, A. P. (2012), "Introduct ISBN: 9780857095152, 0857095 Gupta Balram (2002), "Aerospac 8121922275	Revolutionizing Aircraft Materials and Processes", Germany: BN: 9783030353469, 303035346X tion to Aerospace Materials", United Kingdom: Elsevier Science, 5153

2. Course	Cognitive	L	Т		Р		
Name	Robotics		-		-		
3. Course		3	0		0		
Code		5	Ŭ		0		
	Course (use tick mar	k) Core ()	PE (✓	PE (✓) OE ()			
5. Pre-	Robotics	6. Frequency	Even	Odd (🗸)	Either Sem	Every Sem	
requisit	e Engineering an		0		0	0	
(if any)	Its Application	marks)	Ý		· ·		
7. Total N		utorials, Practical (as	suming 14	weeks of one	e semester)		
Lectures =	42	Tutorials = 0	Practi	cal = 0			
8. 8. Cou	se Description						
This course	teaches the fundament	tals for the Cognitive I	Robots. Thi	s course prov	vides an introdu	ction about the	
Cybernetic	View of Robot Cognit	ion and Perception, Ma	p Building	, materials u	sed for aerospa	ce applications.	
The course	gives a detailed know	ledge of the Randomiz	ed Path Pl	anning and S	Simultaneous L	ocalization and	
Mapping (S	LAM). Also provide th	ne detailing of Robot P	ogrammin	g Packages a	nd Imaging Geo	ometry.	
0 L	a objectives Student	s undergoing this cours	0.000 0000	atad to			
	vide an overview of tel	00	e are expe				
,			avatama				
	-	networked telerobotic	-				
···) D	1 1 1 1 1						
	vide knowledge on the						
	-	functions of online rol of robot manipulation a		ration.			
iv) Exp	lain the fundamentals		ind teleope				
iv) Exp 10. Course	lain the fundamentals	of robot manipulation a course completion stud	ind teleope				
iv) Exp10. Coursei) Dis	lain the fundamentals Outcomes (COs): On cuss about the basic pr	of robot manipulation a course completion stud	ind teleope lents will b	e able to	ed telerobotic sy	ystems.	
 iv) Exp 10. Course i) Dis ii) Des 	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v	of robot manipulation a course completion stud inciples of telerobotic	and teleope lents will b munication	e able to for networke			
 iv) Exp 10. Course i) Dis ii) Des iii) Des 	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com	Ind teleope lents will b munication d interface	e able to for networke for networke			
 iv) Exp 10. Course i) Dis ii) Des iii) Des iii) Ana 	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com oftware architecture an	Ind teleope lents will b munication d interface	e able to for networke for networke			
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 iv) Exp 10. Course i) Dis ii) Des iii) Des iii) Des iv) Ana 11. Unit with 	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the so lyze the performance of detailed content	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com oftware architecture an	Ind teleope lents will b munication d interface lled throug nit: Cybe	e able to for networke for networke h the web.	d robot systems	s on the web.	
iv) Exp 10. Course i) Dis ii) Des iii) Des iv) Ana 11. Unit with Unit-1	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the so lyze the performance e detailed content Number of lectures = 10	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com of the architecture an of mobile robots contro Title of the u Perception, Ma	Ind teleope lents will b munication d interface lled throug nit: Cybe o Building	e able to for networke for networke h the web. ernetic View	d robot systems	s on the web.	
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iv) Exp 10. Course i) Dis ii) Des iii) Des iii) And 11. Unit with Unit-1	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se lyze the performance of the detailed content Number of lectures = 10 n to the Model of C Tools and Robot Cogn	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com of mobile robots contro Title of the u Perception, Ma ognition, Visual Perce	Ind teleope lents will b munication d interface lled throug nit: Cybe 5 Building pption, Vis	e able to for networke for networke h the web. ernetic View ual Recognit	d robot systems of Robot (tion, Machine	s on the web. Cognition and Learning, Soft	
iv) Exp 10. Course i) Dis ii) Des iii) Des iii) Ana 11. Unit wi Unit-1 Introduction Computing Introduction	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se lyze the performance is detailed content Number of lectures = 10 n to the Model of C Tools and Robot Cogn , Constructing a 2D W	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com oftware architecture an of mobile robots contro Title of the u Perception, Ma ognition, Visual Perce	Ind teleope lents will b munication d interface lled throug nit: Cybe o Building eption, Vis re for Map	e able to for networke for networke h the web. Frnetic View ual Recognit Building, Ex	d robot systems v of Robot (tion, Machine planation of the	s on the web. Cognition and Learning, Soft	
iv) Exp 10. Course i) Dis ii) Des iii) Des iii) Ana 11. Unit wi Unit-1 Introduction Introduction Illustration	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se lyze the performance of the detailed content Number of lectures = 10 n to the Model of C Tools and Robot Cogn , Constructing a 2D W of Procedure Traverse	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com of mobile robots contro Title of the u Perception, Ma ognition, Visual Perce ition. orld Map, Data Structu	Ind teleope lents will b munication d interface lled throug nit: Cybe o Building eption, Vis re for Map	e able to for networke for networke h the web. Frnetic View ual Recognit Building, Ex	d robot systems v of Robot (tion, Machine planation of the	s on the web. Cognition and Learning, Soft	
iv) Exp 10. Course i) Dis ii) Des iii) Des iv) Ana 11. Unit with Unit-1 Introduction Computing Introduction Illustration Execution of	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se lyze the performance e detailed content Number of lectures = 10 n to the Model of C Tools and Robot Cogn , Constructing a 2D W of Procedure Traverse f the Map Building Pro-	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com of mobile robots contro Title of the u Perception, Ma ognition, Visual Perce ition. orld Map, Data Structu e Boundary, An Illustr	Ind teleope lents will b munication d interface lled throug nit: Cybe D Building eption, Vis re for Map ation of Pr	e able to for networke for networke h the web. Frnetic View ual Recognit Building, Expocedure Map	d robot systems v of Robot (tion, Machine planation of the p Building, Rol	s on the web. Cognition and Learning, Soft Algorithm, An bot Simulation,	
iv) Exp 10. Course i) Dis ii) Des iii) Des iii) Ana 11. Unit wi 11. Unit wi Unit-1 Introduction Computing Introduction Illustration Execution of Unit - 2	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se lyze the performance of the Model of C Tools and Robot Cogn , Constructing a 2D W of Procedure Traverse f the Map Building Pro Number of lect	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com of mobile robots contro Title of the u Perception, Ma ognition, Visual Perce ition. forld Map, Data Structu e Boundary, An Illustr ogram. ures = 11 Title o	Ind teleope lents will b munication d interface lled throug nit: Cybe 5 Building eption, Vis re for Map ation of Pr	e able to for networke for networke h the web. Frnetic View ual Recognit Building, Ex ocedure Map	d robot systems v of Robot (tion, Machine planation of the o Building, Rol d Path Plannir	s on the web. Cognition and Learning, Soft Algorithm, An bot Simulation,	
iv) Exp 10. Course i) Dis ii) Des iii) Des iv) Ana 11. Unit with Unit-1 Introduction Computing Introduction Execution of Unit − 2 Introduction	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se lyze the performance e detailed content Number of lectures = 10 n to the Model of C Tools and Robot Cogn , Constructing a 2D W of Procedure Traverse f the Map Building Pro Number of lect , Representation of th	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com of mobile robots contro Title of the u Perception, Ma ognition, Visual Perce ition. orld Map, Data Structure Boundary, An Illustr ogram. ures = 11 Title of e Robot's Environmer	Ind teleope lents will b munication d interface lled throug nit: Cybe o Building eption, Vis re for Map ation of Pr of the unit: t, Review	e able to for networke for networke h the web. Frnetic View ual Recognit Building, Ex focedure Map Randomize of configurat	d robot systems o of Robot (tion, Machine planation of the b Building, Rol d Path Plannir tion spaces, Vis	s on the web. Cognition and Learning, Soft Algorithm, An bot Simulation, ng sibility Graphs,	
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iv) Exp 10. Course i) Dis ii) Des iii) Des iii) Des iv) Ana 11. Unit with Unit-1 Introduction Computing Introduction Computing Introduction Execution of Unit – 2 Introduction Voronoi dia Roadmaps,	lain the fundamentals Outcomes (COs): On cuss about the basic pr cribe the concepts of v ign and fabricate the se lyze the performance of the the performance of the the performance of the the model of C Tools and Robot Cogn , Constructing a 2D W of Procedure Traverse f the Map Building Pro f the Map Building Pro Number of lect , Representation of the the trapidly exploring randometer	of robot manipulation a course completion stud inciples of telerobotic vired and wireless com of mobile robots contro Title of the u Perception, Ma ognition, Visual Perce ition. orld Map, Data Structure Boundary, An Illustr ogram. ures = 11 Title of the Robot's Environmer ds and Cell Decompo om trees, Execution of	Ind teleope lents will b munication d interface lled throug nit: Cybe D Building eption, Vis re for Map ation of Pr of the unit: t, Review sition, plar the Quad t	e able to for networke for networke h the web. Frnetic View ual Recognit Building, Ex focedure Map Randomize of configurationing with minee-Based Par	d robot systems o of Robot (tion, Machine planation of the b Building, Rol d Path Plannir tion spaces, Vis noving obstacle th Planner Prog	s on the web. Cognition and Learning, Soft Algorithm, An bot Simulation, ng sibility Graphs, s, Probabilistic gram.	
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Robot Parameter Display, Program for Bot Speak, Program for Sonar Reading Display, Program for Wandering Within the Workspace, Program for Tele-operation, A Complete Program for Autonomous Navigation. Module

Introduction – Necessity for 3D Reconstruction – Building Perception – Imaging Geometry – Global Representation – Transformation to Global Co-ordinate System

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

Journa	r papers, r atents in the respective field.
13. Bo	oks Recommended
Text B	looks
i)	Patnaik, Srikanta, "Robot Cognition and Navigation - An Experiment with Mobile Robots", Springer
	Verlag Berlin and Heidelberg, 2007.
ii)	Howie Choset, Kevin LynchSeth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki, and
	Sebastian Thrun, "Principles of Robot Motion-Theory, Algorithms, and Implementation", MIT Press,
	Cambridge, 2005.
Refere	nce Books
i)	Sebastian Tharun, Wolfram Burgard, Dieter Fox, "ProbabilisticRobotics", MIT Press, 2005.
ii)	Margaret E. Jefferies and Wai-Kiang Yeap, "Robotics and Cognitive Approaches to Spatial
	Mapping", Springer-Verlag Berlin Heidelberg 2008.
iii)	HoomanSomani,"Cognitive Robotics", CRC Press, 2015.
iv)	Jared Kroff,"Cognitive Robotics: Intelligent Robotic Systems", Wilford Press, 2016.

2. Course Name	Autonomous Vehicle	L	Т			Р	
3.Course Code		3	0	0		0	
4.Type of Cou mark)	ırse (use tick	Core ()	PE (√)		OE ()	
5.Pre-	Automobile	6.Freque	ncy (use Ever	n Ode	d (✔)	Either Sem	Every Sem
requisite (if any)	technology	tick marl	-			0	0
7.Total Numb	per of Lectures, Tu	torials, Pra	actical (assumi	ng 14 v	veeks o	f one semeste	r)
Lectures = 42	2	Tutorials	s = 0 Prac	tical =	: 0		
opportunities 9. Learning of i) Introdu ii) Gain I vehicle iii) Unders iv) To lear 10. Course Or i) Descrii ii) Compa iii) Discus iv) Summa v) Identif vi) Outling	ice the fundamental Knowledge about t	aspects of a he Sensing ity Aspects as vehicle to completion Automotive e of sensing omputer vis connectivity s of automa llers employ	Autonomous Ve g Technology a and the issues in echnology and i n of this course, Electronics and mechanisms in ion and learning y fundamentals ition involved ir	ehicles. and Alg nvolved ts bigg the stu l the op volved g algori existing an Au	gorithm d in drivest Char dents veration in Auto thms ir g in a di tonomo	verless cars. llenges. vill be able to of ECUs. onomous Vehi vehicles. riverless car.	Autonomou
Unit-1	Number of	Title of t	he unit: Introd	uction			
	lectures = 10						
	Automotive Electron on of ECUs -Infotai stems-Autonomous	nment, Boc Vehicles	ly, Chassis, and	Power	train El		anced Drive
Assistance Sys	Number of lectur	res = 10					latonomou
Assistance Sys Unit – 2 Basics of Rada	Number of lecture ar Technology and Stera Technology -Ni Number of lecture	Systems -U ght Vision	Vehicles Itrasonic Sonar	System se of Se	is -LID ensor D	AR Sensor Tea ata Fusion -Ka	chnology an alman Filters

Computer Vision Fundamentals -Advanced Computer Vision -Neural Networks for Image Processing –TensorFlow -Overview of Deep Neural Networks -Convolutional Neural Networks, Connectivity Fundamentals - DSRC (Direct Short Range Communication) - Vehicle-to-Vehicle Technology and Applications -Vehicle-to-Roadside and Vehicle-to-Infrastructure Applications -Security Issues.

Unit – 4	Number of lectures = 10	Title of the unit: Autonomous Vehicle Technology	
		and its biggest Challenges	

Driverless Car Technology-Different Levels of Automation -Localization - Path Planning. Controllers to Actuate a Vehicle - PID Controllers -Model Predictive Controllers, ROS Framework, Technical Issues, Security Issues, Moral and Legal Issues.

12. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

- i) Hong Cheng, "Autonomous Intelligent Vehicles: Theory, Algorithms and Implementation", Springer, 2011.
- **ii**) Williams. B. Ribbens: "Understanding Automotive Electronics", 7th Edition, Elsevier Inc, 2012.

Reference Books

- i) Shaoshan Liu, Liyun Li, "Creating Autonomous Vehicle Systems", Morgan and Claypool Publishers, 2017.
- **ii**) Marcus Maurer, J.ChristianGerdes, "Autonomous Driving: Technical, Legal and Social Aspects" Springer, 2016.
- iii) Ronald.K.Jurgen, "Autonomous Vehicles for Safer Driving", SAE International, 2013.
- iv) James Anderson, KalraNidhi, Karlyn Stanly, "Autonomous Vehicle Technology: A Guide for Policymakers", Rand Co, 2014.
- v) Lawrence. D. Burns, ChrostopherShulgan, "Autonomy The quest to build the driverless car and how it will reshape our world", Harper Collins Publishers, 2018

2. Cour	se Name	Automation in	L	Т		Р	
	se i tunie	Manufacturing		-		-	
		Lab					
3. Cour	se Code		0	0		4	
	of Course (us	e tick mark)	Core (✓)	PE ()		• • • • • • • • • • • • • • • • • • • •	
	requisite (if	Manufacturing	6. Frequency (use	Even ()	Odd	Either	Every
any)	equisite (ii	Processes and	tick marks)	Lven()	(✔)	Sem ()	Sem (
J))		Technology &			(,)	Sem ()	Sem (
		Engineering					
		Graphics and					
		Design					
7 Total	Number of I	8	 Practical (assuming 14 w	reeks of one	somostor		
Lectures		ectures, rutoriais, r	Tutorials = 0	Practica)	
	se Description	•	1 4401 4415 - 0	Tructicu	1 - 00		
	<u> </u>		mputer systems to assist	in the creatic	n modif	ication an	alvsis c
		U U	ed to increase the product				•
•	•		documentation, and to cr	•	0	•	-
•	•	e	for print, machining, or o				0
-			in the Product develop		-	-	
	-		tworking in manufacturin				inacturin
-	ning objective	<u>,</u>	tworking in manufacturin		/II t.		
			M and concepts of comp	uter graphics			
			oncerned to the manufact			reas	
		0					
	o unucistanti u	he latest advances in t	the manufacturing perspec	•			
iv) T		he latest advances in t of Computer Integrat	the manufacturing perspected Manufacturing.	•			
	'o have an idea	of Computer Integrat	0 1	ctives and th	eir applic		
10. Cour i) T	<u>'o have an idea</u> se Outcomes ('o understand th	of Computer Integrat (COs): On completion he importance of CAI	ted Manufacturing. n of this course, the stude D/CAM principles in Proc	ctives and th	eir applic		
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10. Cour i) T ii) T iii) T iv) T 11. Unit Sr. No. 1 2	io have an idea ise Outcomes (io understand th io develop prog io understand th io understand th io understand th io understand th wise detailed of Title Use and lea Constructio Crankshaft, springs. Assembly of drawings of Italian for the second sec	of Computer Integrat (COs): On completion he importance of CAI grams related to manu- he concept of group to n details about compu- content arm import/export tech on of simple machi- , Pulley, Piston, Con- drawing with section f assemblies: Lathe Ta	ted Manufacturing. n of this course, the stude D/CAM principles in Proc facturing using codes. echnology and flexible manufactur inter integrated manufactur iniques and customization ine parts and compone nnecting rod, nuts, bolts	ctives and th ents will be a duct develop anufacturing ring. n of software ents like Co s, gears and from given	eir applic ble to: ment. system.	COs cov)
10. Cour i) T ii) T iii) T iv) T 11. Unit Sr. No. 1 2 3	io have an idea ise Outcomes (io understand th io develop prog io understand th io constructio Crankshaft, springs. Assembly of drawings of jigs and Mi iii	of Computer Integrat (COs): On completion he importance of CAI grams related to manu- he concept of group to n details about compu- content urn import/export tech on of simple machi- , Pulley, Piston, Con- drawing with sectioni f assemblies: Lathe Ta lling fixture.	n of this course, the stude D/CAM principles in Proc afacturing using codes. echnology and flexible manufactur inter integrated manufactur iniques and customization ine parts and compone meeting rod, nuts, bolts ing and bill of materials and stock, Machine vice, Pe	ctives and th ents will be a duct develop anufacturing ring. n of software ents like Co s, gears and from given	eir applic ble to: ment. system.	COs cov i i)))
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10. Cour i) T ii) T iii) T iii) T 11. Unit Sr. No. 1 2 3 4 5 6	io have an idea ise Outcomes (io understand th wise detailed of Title Use and lea Construction Crankshaft, springs. Assembly of drawings of jigs and Mi Make the part Tool path g Part program Part program	of Computer Integrat (COs): On completion he importance of CAI grams related to manu- he concept of group to n details about compu- content arm import/export tech on of simple machi- on of simple machi- f assemblies: Lathe Ta lling fixture. art family/family tabl eneration mming	ted Manufacturing. n of this course, the stude D/CAM principles in Pro- facturing using codes. echnology and flexible ma- inter integrated manufactur aniques and customization ine parts and compone nnecting rod, nuts, bolts ing and bill of materials anil stock, Machine vice, Per- e of a bolt	ctives and th ents will be a duct develop anufacturing ring. n of software ents like Co s, gears and from given	eir applic ble to: ment. system.	COs cov i i i i i i i i)))))))
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	iv) Canned Cycle operations	
10	Part Programming	ii), iv)
	i) Straight, Taper and Radius Turning.	
	ii) Thread Cutting.	
	iii) Rough and Finish Turning Cycle.	
	iv) Drilling and Tapping Cycle.	
11	Contour milling using CNC milling machine	ii), iv)
12	Spur gear cutting in CNC milling machine	ii), iv)
13	CL Data and Post Process generation using CAM packages.	ii), iv)
14	Application of CAPP in Machining and Turning Centre.	ii), iv)

Department Electives-IX Lab

1.	Name of the Depa	rtment- Mechanic	al Engineering					
2.	Course Name	Nuclear Power	L]	Г]	P
		Engineering						
		Lab						
3.	Course Code		0		()		2
4.	Type of Course (u	se tick mark)	Core ()		PE (✓)		OE ()	
5.	Pre-requisite (if	Engg.	6. Frequency (use	Even	Odd	Either	Every
	any)	Thermodynami	tick marks)		0	(✔)	Sem ()	Sem ()
		cs						
7.	Total Number of	Lectures, Tutorials	s, Practical (assur	ning 1	4 weeks	of one se	mester)	
Le	ctures = 0		Tutorials = 0		Practic	al = 28		

8. Course Description

Nuclear Power Engineering concentrate on the principles, techniques and processes involved in generation of power from nuclear fuels. This involves studying and exploring various aspects of science ranging from processing of nuclear fuel to merits and demerits of various nuclear reactors and from reprocessing of nuclear waste to their safely disposal. Upon completion of this course students will be able to have better understanding of nuclear processes involved in nuclear power generation, know working and pros & cons of various reactors and also have understanding of nuclear power generation and safety rules implemented during power generation from nuclear fuels and nuclear waste disposal.

9. Learning objectives:

- i) The student will be exposed to the basic physics of nuclear reactions and operation of nuclear reactors.
- ii) To learn various types of power generation methods, safety and its impact on environment.
- iii) Give understanding of Separators used in reactors.
- iv) Learn about how to dispose the waste and get protected from radiations.

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Know the nuclear fission and fusion processes.
- ii) Understand the working of a nuclear reactors
- iii) Understand power generation and safety aspects.

iv) Able to apply the concepts of waste disposal and radiation protection.

11. Lab	Content	
Sr. No.	Title	COs covered
1	Nuclear Reactors	i), ii)
2	Reactor Materials	ii)
3	Reprocessing	iii)
4	Separation	iii)
5	Waste Disposal and Radiation Protection	iv)
6	Protection	iii

2.	Name of th	e Department- Med	chanical Engineerin	g			
3.	Course	Machine Tool	L		Т		Р
	Name	Technology Lab					
4.	Course		0		0		2
	Code						
5.	Type of Cou mark)	urse (use tick	Core ()	PE (✓)	OE ()	EAS ()	BSC ()
6.	Pre-	Manufacturing	7. Frequency	Even (✓)	Odd ()	Either Sem	Every Sem
	requisite	Processes and	(use tick			0	0
	(if any)	Technology	marks)				V
8.	Total Numb	er of Lectures, Tut	orials, Practical (as	suming 14 we	eks of one	semester)	
	Lectures = (00	Tutorials = 0	Practio	cal = 28		
9. Course Description							
Stuc	ly of differen	t machine tools and	hence educates the	students abou	t the scope	of the subject.	To train the
stud	ents in the mo	etal cutting domain s	o as to equip them w	vith adequate 1	knowledge	about the vario	us processes.
		on the prominent the		-	-		-

To emphasize upon the prominent theories, concepts and constructional features of machines related to them. To provide an insight about the super finishing operations of gear generating. To lay groundwork for further studies in manufacturing stream.

10. Learning objectives:

- i) The course provides students with fundamental knowledge and principles of tool design.
- ii) To demonstrate the fundamentals of machining tool guide ways.
- iii) To develop fundamental knowledge of gear generating processes.
- iv) Understand the basics of press tool engineering and jigs- fixtures.

11. Course Outcomes (COs): The curriculum of the Department is designed to satisfy the diverse needs of students.

- i) Understand the cutting tool geometry, mechanism of machine tool design.
- ii) Understand the machining tool guide ways to produce a component.
- iii) Acquire knowledge of gear generation process with applications, advantages and disadvantages
- iv) Acquire knowledge of the basics of press tool engineering and jigs-fixtures.

Sr. No.	Title	COs covered
1	Tool grinding (to provide tool angles) on tool-grinder machine.	i)
2	Experiments on turning and facing on lathe	i)
3	To perform step turning and thread cutting on lathe.	i)
4	To perform taper turning operation on lathe	ii)
5	To perform knurling, drilling operation on lathe.	ii)
6	To study the characteristic features of Milling machine and shaper machine.	ii)
7	To perform Gear cutting on Milling machine.	iii)
8	To study the Machining a block on shaper machine.	iii)

9	To study the Finishing of a surface on surface-grinding machine.	iii)
10	To study the Drilling holes on drilling machine and study of twist-drill.	iv)
11	Study of different types of tools and its angles & materials.	iv)
12	Experiment on jigs/Fixtures and its uses	iv)

2.	Course Name	Recent Trends in Automotive Technology Lab	L]	Γ]	P
3.	Course Code		0	()		2
4.	Type of Course	use tick mark)	Core ()	PE (✓)		OE ()	
5.	Pre-requisite (if	IC Engines,	6. Frequency (use	Even ()		Either	Every
	any)	Automobile	tick marks)		(✔)	Sem ()	Sem ()
7	Total Number of	Engineering	ractical (assuming 14 we	eks of one	semester)		
	1000000000000000000000000000000000000	Lectures, rutoriais, ri	Tutorials = 0	Practica			
8.	Course Descript	on		Tructicu			
	-		est trends in automotive i	ndustry use	d in evalua	tion of w	vorld.
Th	is includes underst	anding the basic principle	es of various hybrid and e	lectric vehi	cles with in	nportanc	ce,
app	plications and limit	ations.					
9.	Learning objecti						
		ne suspension, brakes and	•				
	·	ne vehicle operation and					
		ne Electric and Hybrid Vo ne Latest Engine Technol		Systems			
			102×10 atures and 42×000				
10	. Course Outcome	-	21	-	ble to		
10		es (COs): On completion	of this course, the studen	-	ble to		
10	i) Know the Hy	es (COs): On completion brid, Battery and Magne	of this course, the studentic track Vehicle.	-	ble to		
10	i) Know the Hyii) Describe the	es (COs): On completion	of this course, the studen tic track Vehicle. motive.	-	ble to		
10	i) Know the Hyii) Describe theiii) Describe the	es (COs): On completion brid, Battery and Magne computer control in auto	of this course, the studen tic track Vehicle. motive. fe ad fast travel.	-	ble to		
11.	 i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content 	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I	of this course, the studen tic track Vehicle. motive. fe ad fast travel.	-	ble to		
11.	i) Know the Hyii) Describe theiii) Describe theiv) Know the late	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I	of this course, the studen tic track Vehicle. motive. fe ad fast travel.	-	ble to	CC	
11.	 i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content 	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle	of this course, the studen tic track Vehicle. motive. fe ad fast travel. ndustry.	ts will be a			vered
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. Ti 1 To	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle	of this course, the studen tic track Vehicle. motive. fe ad fast travel. ndustry.	ts will be a	cle.		i)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. Ti 1 To	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle	of this course, the studen tic track Vehicle. motive. fe ad fast travel. ndustry.	ts will be a	cle.		vered
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. Ti 1 To 2 To 3 To	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and co o study the working and co o study about the latest s	of this course, the studen tic track Vehicle. motive. fe ad fast travel. ndustry. constructional details of E constructional details of H afety features like EBD,	lectric vehi	cle.	cov	i)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. Ti 1 To 2 To 3 To	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and co o study the working and co	of this course, the studen tic track Vehicle. motive. fe ad fast travel. ndustry. constructional details of E constructional details of H afety features like EBD,	lectric vehi	cle.	cov	i)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. Ti 1 To 2 To 3 To Tr	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and construction and Stability control	constructional details of H afety features like EBD, .	lectric vehi	cle.	ng,	vered i) i) ii), iii)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. Ti 1 To 2 To 3 To Tr	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and co o study the working and co o study about the latest s	constructional details of H afety features like EBD, .	lectric vehi	cle.	ng,	i)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. Ti 2 To 3 To 4 To	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and construction and Stability control	of this course, the studen tic track Vehicle. motive. fe ad fast travel. ndustry. constructional details of E constructional details of H afety features like EBD, rol.	lectric vehi	cle.	ng,	vered i) i) ii), iii)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content 1 Tr 2 Tr 3 Tr 4 Tr 5 Tr	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and c o study the working and c o study about the latest s action and Stability contr o study the working of Co	of this course, the studentic track Vehicle. motive. fe ad fast travel. ndustry. constructional details of E constructional details of H afety features like EBD, rol.	lectric vehi	cle.	ng,	vered i) i) ii), iii) ii), iii)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. 71 2 70 3 70 4 70 5 70 6 70	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and c o study the working and c o study about the latest sa action and Stability control o study the working of Co o study the various Conve o study in detail about the	of this course, the studentic track Vehicle. motive. fe ad fast travel. ndustry. constructional details of E constructional details of H afety features like EBD, rol.	lectric vehi ybrid vehic	cle. cle. ronic Braki	ng,	vered i) i) ii), iii) ii), iii) ii), iii)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content No. 710 710 710 710 710 710 710 710 710 710	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and c o study the working and c o study about the latest s action and Stability contr o study the working of Co o study the various Conve o study in detail about the o study in detail about the	constructional details of H afety features like EBD, for the student of this course, the student of the student	ts will be a lectric vehi ybrid vehic ABS, Elect	cle. cle. ronic Braki	ng,	vered i) i) ii), iii) ii), iii) ii), iii) ii)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content in 1 Tr 2 Tr 3 Tr 4 Tr 5 Tr 6 Tr 5 Tr 6 Tr 7 Tr 7 Tr	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and c o study the working and c o study about the latest s action and Stability contr o study the working of Co o study the various Conve o study in detail about the o study in detail about the o study the function and v	constructional details of H afety features like EBD, a rol. constructional system enience Systems. e 42 Volt System. e working of Regenerative	e Braking S n Engines.	cle. cle. ronic Braki	ng,	vered i) i) ii), iii) ii), iii) ii), iii) ii) ii)
11.	i) Know the Hy ii) Describe the iii) Describe the iv) Know the late Lab Content Tre No. Tre 1 Tre 2 Tre 3 Tre 4 Tre 5 Tre 6 Tre 7 Tre 8 Tre 9 Tre	es (COs): On completion brid, Battery and Magne computer control in autor working of vehicle for sa est trend in Automotive I tle o study the working and c o study the working and c o study about the latest s action and Stability contr o study the working of Co o study the various Conve o study in detail about the o study in detail about the o study the function and v o study about the applicat	constructional details of H afety features like EBD, a rol. collision warning system enience Systems. e 42 Volt System. e working of Turbo Boost in	e Braking S n Engines.	cle. ele. ronic Braki	ng,	vered i) i) ii), iii) ii), iii) ii), iii) ii) ii) ii) iv)

2. Course Name	Maintenance Engineering Lab]	L	r.	Γ	I	
3. Course Code			0	(0	2	2
	urse (use tick mark)	Core ()	EAS ()	PE (✓)	OE ()	
5. Pre- requisite (if any)		6. Frequence marks)	cy (use tick	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Numb Lectures = 0	per of Lectures, Tutoria	als, Practical (a Tutorials = (one sen cal = 28		
	oduces the concepts of h	Maintenance ca	tegories Com	parative	merits o	f each ca	tegory
with TPM. 9. Learning obj	tenance, maintenance sc	hedules, repair	cycle and Prin	ciples and	d metho	ds of lub	rication
with TPM. 9. Learning obj i) To know Managen ii) To enable analysis f iii) To introd	tenance, maintenance sc jectives: the structure, operation a	hedules, repair and applications ematical, comput	of the concept tational and con	s of Indus mmunicati	d metho strial ma ion skills th and w	ds of lub intenance to learn t	and its
 with TPM. 9. Learning obj i) To know Managen ii) To enable analysis f iii) To introd iv) To introd 10. Course Outco i) Define an 	itenance, maintenance sc jectives: the structure, operation a nent. e the students, apply mathe for maintenance a system. uce students' concept of C	hedules, repair and applications ematical, compute ondition Monitor ey features of Inc al completion of Principles of main	of the concept tational and con ring, Cost comp dustrial and Tot this course, the ntenance planni	s of Indus mmunicati parison wi al Quality	d metho strial ma ion skills th and w Manage	ds of lub intenance to learn t ithout CM ement.	and its
 with TPM. 9. Learning obj i) To know Managen ii) To enable analysis f iii) To introd iv) To introd 10. Course Outco i) Define ar ii) Perform f 	jectives: the structure, operation a nent. the students, apply mather for maintenance a system. uce students' concept of C uce students' concept of k comes (COs): On successfue ad measure various Basic F	hedules, repair and applications ematical, compute ondition Monitor ey features of Inc ul completion of Principles of main enance a system.	of the concept tational and con ring, Cost comp <u>dustrial and Tot</u> this course, the ntenance planni	s of Indus mmunication parison wi al Quality student wing.	d metho strial ma ion skills th and w <u>Manage</u> vill be ab	ds of lub intenance to learn t ithout CM ement.	and its
 with TPM. Learning obj i) To know Managen ii) To enable analysis f iii) To introd iv) To introd 10. Course Outer i) Define ar ii) Perform f iii) Apply the 	jectives: the structure, operation a nent. the students, apply mathe for maintenance a system. uce students' concept of C uce students' concept of k comes (COs): On successfund measure various Basic F full cost analysis for mainter	hedules, repair and applications ematical, comput ondition Monito ey features of Inc al completion of Principles of main enance a system. nitoring Cost con	of the concept tational and con ring, Cost comp <u>lustrial and Tot</u> this course, the ntenance planni	s of Indus mmunication parison wi al Quality student wing.	d metho strial ma ion skills th and w <u>Manage</u> vill be ab	ds of lub intenance to learn t ithout CM ement.	and its
 with TPM. Learning obj i) To know Managen ii) To enable analysis f iii) To introd iv) To introd 10. Course Outer i) Define ar ii) Perform f iii) Apply the 	itenance, maintenance sc jectives: the structure, operation a nent. the students, apply mathe for maintenance a system. uce students' concept of C uce students' concept of k comes (COs): On successful ad measure various Basic F full cost analysis for mainter concept of Condition Mo tey features of Industrial an	hedules, repair and applications ematical, comput ondition Monito ey features of Inc al completion of Principles of main enance a system. nitoring Cost con	of the concept tational and con ring, Cost comp <u>lustrial and Tot</u> this course, the ntenance planni	s of Indus mmunication parison wi al Quality student wing.	d metho strial ma ion skills th and w <u>Manage</u> vill be ab	ds of lub intenance to learn t ithout CM ement.	and its

		covered
1	To Study the benefits of sound Maintenance systems using case study.	i)
2	To Study the maintenance organization using case study.	i)
3	To study the principles and methods of lubrication using TPM.	ii)
4	To Study the maintenance schedules, using case study.	ii)
5	To Study the Preventive maintenance-using case study.	ii)

6	To study the Methods and instruments for CM – Temperature sensitive	iii)
	tapes.	
7	To study the techniques for Pistol thermometers – wear-debris analysis	iii)
8	To study the Cost comparison with and without CM – On-load testing and offload testing.	iii)
9	To study the Job order systems -Use of computers in maintenance.	iv)
10	To study the Logical fault location methods	iv)

1.	Name of the De	epartment- Mechanical	Engineering					
2.	Course Name	Operation Research Lab]		,	Γ	I	
3.	Course Code		()	1	0	2	2
4.	Type of Course	e (use tick mark)	Core ()	EAS ()	PE (✓))	OE ()	
5.	Pre-requisite (if any)		6. Frequency marks)	y (use tick	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tutorials,	Practical (assur	ning 14 weeks	of one set	mester)		I.
Le	ectures = 0		Tutorials = 0		Practic	cal = 28		

8. Course Description

Operation research is having many powerful tools to optimize the real-life problems. The study of this subject will give knowledge to the students regarding transportation and inventory related problems. This also describes the method of sequencing of jobs through different number of machines. Focus is also given to most common problems of waiting of either job/machines/peoples. Emphasis is given to decision models and replacement problems. So, the study of this subject will develop the capability among students to solve effectively many problems arising during their career.

9. Learning objectives:

- i) To provide students the knowledge of Linear model.
- **ii**) To enable the students, apply mathematical, computational and communication skills to learn Sequencing and Networks needed for the practical utility of Operations Research.
- iii) To introduce students concept of inventory model in Operations Research.
- iv) To introduce students concept of Queuing Models and decision models

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Apply the concept of Linear model to solve various transportation problems.
- ii) Apply the concept of Sequencing and Networks to optimize the production
- iii) Apply the concept of inventory model to maximize the profit.
- iv) Apply the concept of Queuing Models and decision models to forecast the demand in the industry.

11. Lab Component

Sr. No.	Title	COs covered
1	To Study the Linear Programming - Mathematical Formulation.	i)
2	To Study the transportation problem using case study.	i)
3	To study the M' machines using modified Johnson's method.	ii)
4	To Study the Project Network – CPM using case study	ii)
5	To Study the Project Network –PERT using case study	ii)
6	To study the Stochastic Inventory models	iii)

7	To study the techniques for EOQ–Deterministic inventory models	iii)
8	To study the Decision models – Game theory	iii)
9	To study the Queuing models	iv)
10	To study the Monte-Carlo Simulation models	iv)

1. Name of the De	partment- Mechanica	al Engineering				
2. Course Name	Instrumentation	L		Τ		Р
	and Control					
	Engineering Lab					
3. Course Code		0		0		2
4. Type of Course	(use tick mark)	Core ()	PE (✓)		OE ()	
5. Pre-requisite	NIL	6. Frequency	Even ()	Odd (✔)	Either	Every
-		(use tick marks)			Sem ()	Sem ()
7. Total Number	of Lectures, Tutorials	, Practical (assuming 1	4 weeks of	one semester	·)	
Lectures = 00		Tutorials = 00	Prac	ctical = 28		

8. Course Description:

The objective of this Lab-work course is to provide students with sufficient hands-on experience in working with different instruments. This course combines knowledge, techniques, and methodologies from various sources, using techniques from transform theory and basic principle of classical physics based upon which different instruments and sensors are built.

9. Learning Objectives:

- i) To understand the principles of measurements, methods of measurements and its application in manufacturing industries.
- ii) To understand the principles of temperature and force measurements.
- iii) To understand the principles of flow and displacement measurements.
- iv) To understand the principles of speed measurement and use of strain gauges.

10. Course Outcomes (Cos): On completion of this course, the students will be able to

- i) Demonstrate the various parameters of measurements using instruments.
- ii) Determine the magnitude of parametric measurements such as load, torque and temperature.
- iii) Measure displacement and flow using different instruments.
- iv) Measure speed and know the various uses of strain gauges.

11. Lab c	omponent	
Sr. No.	Title	COs covered
1	To study the characteristics of LVDT	i), iii)
2	To measure the load using load cell	i), ii)
3	To measure the temperature using thermocouple	i), ii)
4	Measurement of torque using torque measurement setup.	i), ii)
5	To measure the temperature using RTD	i), ii)
6	Speed measurement using stroboscope	i), iv)
7	Flow measurement experiment.	i), iii)
8	DC motor speed control	i), iii)

9	Experiment on Dynamometers.	i), iii)
10	Strain Measurement using Strain Gauge.	i), iv)

1. Name of the De	epartment- Mechanical	Engineering					
2. Course Name	Nano-Technology and Surface Engineering Lab	1]	Г	I	
3. Course Code		()	(0	2	2
4. Type of Course	e (use tick mark)	Core ()	EAS ()	PE (✓))	OE ()	
5. Pre-requisite (if any)		6. Frequency marks)	v (use tick	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
	of Lectures, Tutorials,		ning 14 weeks o				
Lectures = 0		Tutorials = 0		Practic	al = 28		
8. Course Descrip	otion						
Surface engineering	g is a sub-discipline of M	Aaterials Science	e and Materials	Enginee	ring whi	ch deals v	with the
surface of a solid an	d its modifications. The	primary goal of	Surface Engine	ering of r	nanomate	erials is to	modify
the properties of su	rface to improve its elec	trical and therm	al properties, an	nd to imp	prove the	e compatil	oility of
nanomaterials with	some matrix when they	are used as rein	forcing fillers in	n compos	ites for l	high perfo	ormance
applications. The co	ourse should give a basic	introduction to c	chemical and ph	ysical pri	nciples i	n the synt	hesis of
inorganic nanostruc	tured materials. In addition	on, basic princip	les of finite size	effects w	vill be co	vered. The	e course
will also cover d	ifferent methods for s	ynthesis and c	haracterization	of diffe	erent na	nostructui	res and
nanostructured bulk		•					
9. Learning object	tives:						
	nd the basic concepts of	surface enginee	ing				
	nd the basic concepts of	Ū.	C				
iii) To enhance	the knowledge of Nano	material.					
	students to get familiari		ncapsulation				
10. Course Outcon	nes (COs): On completio	on of this course.	, the students wi	ll be able	to		
	ace engineering and Nand						
	nd the basic concepts of						
	y describe how the nano	-	•		rystal str	ucture, rea	activity.
	al properties.		- F	0,,	•	,	- J 7
	icroencapsulation and the	eir application ir	1 industrv				
11. Lab Componer	-		J				
	Fitle					COs	
						cove	

To study the effect of wear on the surface of Nano materials

1

i)

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2	To study the effect of corrosion on the surface of Nano materials	i)
3	To study the effect of friction tribology on the surface of Nano materials	i)
4	To study the nano-structured coatings developed using CVD and PVD	ii)
5	To study the Functional coatings developed using CVD and PVD.	ii)
6	To study the advanced coating developed using CVD and PVD	ii)
7	To study the effect in electrochemical properties of nanostructured coatings.	iii)
8	To study the effect in mechanical properties of nanostructured coatings.	iii)
9	To study the effect in physical and other properties of Nanostructured coatings.	iii)
10	To study the Current trends in surface modification of Nanomaterials.	iv)
11	To study the Current trends in surface Modified Nanomaterials.	iv)
12	To study the Main problems in synthesis of Modified Nanomaterials	iv)

•	Course	Robot Operating	L	Т	T	Р	
	Name	Systems Lab					
•	Course		0	0		2	
	Code						
•	Type of Cours	se (use tick mark)	Core ()	PE (✓)	OE ()		
•	Prerequisite	Materials	6. Frequency	Even ()	Odd	Either	Ever
	(if any)	Engineering and	(use tick		(✔)	Sem	Sem
		Technology	marks)			0	
•	Total Number	of Lectures, Tutorials, I	Practical (assuming 1	14 weeks of one sem	nester)		<u> </u>
Jeo	ctures = 0		Tutorials = 0	Practical = 28			
•	Course Descri	iption					
'ne		is course is to introduce the	e Robot Operating sys	stem. This course giv	ves a brief	understan	ıding
		ecture of operating system		C			Ū.
		various case studies will be		6			
•	Learning obje						
•	0.0	ce the basics of Robot Ope	erating Systems				
	,	tand the Architecture of O					
		e knowledge on the hardwa		2			
		tand the applications of R					
0.		omes (COs): On completio			<i>to</i>		
υ.		be the need for ROS and its				in robot	100
		s about the concepts behind	e		llallus usee	1 111 10001	ics.
		*	0 0	me system.			
	-	the concepts of Node deb		t est and tracta	(DOC		
1		e the issues in hardware in	terfacing and discuss	about the application	ns of KUS		
1.	Lab content		T:41 -				
	Sr. No.		Title			Ds Cover	ea
	1	To study various ROS ar	d their significance.			i)	
	2	To study and understand	÷	s used in Robotics		i)	
	3	To study the Navigation	through file system			ii)	
	4	To study the Debugging	of Nodes.			iii)	
	5	To study the visualizatio				iii)	
	6	To study the Hardware In	nterface of Robots			iv)	
	7	To study the Sensor Inter	c · · · -		1	iv)	

2.	Course Nam	e	Modelling and Simulation of EHV	L		Г]	P
3.	Course Code	e		0	(0	/	2
4.	Type of Cou	rse (use	e tick mark)	Core ()	PE (✓)		OE ()	
5.	Pre-requisite	e (if	Introduction to	6. Frequency (use	Even ()	Odd	Either	Every
	any)		Electric and Hybrid Vehicles	tick marks)		(✔)	Sem ()	Sem ()
7.	Total Numbe	er of Le	-	ractical (assuming 14 we	eks of one	semester)	1	
Le	ctures = 0		, ,	Tutorials = 0	Practica			
8.	Course Desc	ription						
Th	is course introd	duces th	e fundamental conce	pts, principles, analysis a	nd design o	f hybrid ar	nd electric	vehicle
usi	ng the Modelli	ing and	Simulation. The mat	terial for this course will b	e prepared	in such a	manner th	nat it wi
be	useful for grad	luate stu	idents, teachers, pract	titioners and final year und	lergraduate	e students.		
	Learning obj		<u>^</u>	•				
	i) To kr	now the	basics of Modelling	in performance parameter	s.			
			the Modelling of Bat					
	iii) To kr	now the	Drivetrain character	istics using Modelling of i	t.			
	iv) Unde	rstand t	he concept of Energy					
			the concept of Energy	/ Management.				
10	. Course Outc			completion of this course,	the studen	t will be al	ble to	
10		omes (COs): On successful	completion of this course,		t will be al	ble to	
10	i) Unde	omes (erstand t	COs): On successful			t will be al	ble to	
10.	i) Undeii) Mode	omes (erstand t el batter	COs): On successful the modeling of vehic	completion of this course, the performance parameter		t will be al	ble to	
10.	i) Undeii) Modeiii) Descr	comes (erstand t el batter ribe the	COs): On successful the modeling of vehic ry electric vehicles.	completion of this course, ele performance parameter istics.		t will be al	ble to	
	i) Undeii) Modeiii) Descr	comes (erstand t el batter ribe the y the co	COs): On successful he modeling of vehic y electric vehicles. drive train character	completion of this course, ele performance parameter istics.		t will be al	ble to	
11.	i) Under ii) Mode iii) Descr iv) Apply	comes (erstand t el batter ribe the y the co	COs): On successful he modeling of vehic y electric vehicles. drive train character	completion of this course, ele performance parameter istics.		t will be al	ble to	<u> </u>
11.	i) Under ii) Mode iii) Descr iv) Apply Lab Content	comes (erstand t el batter ribe the y the co	COs): On successful he modeling of vehic y electric vehicles. drive train character	completion of this course, ele performance parameter istics.		t will be al		
11.	i) Under ii) Mode iii) Descr iv) Apply Lab Content	comes (erstand t el batter ribe the y the co	COs): On successful he modeling of vehic y electric vehicles. drive train character	completion of this course, ele performance parameter istics.		t will be al		
11.	i) Unde ii) Mode iii) Descr iv) Apply Lab Content No.	romes (erstand t el batter ribe the y the co Title	COs): On successful the modeling of vehic ry electric vehicles. drive train character oncepts of energy man	completion of this course, ele performance parameter istics.	s.	t will be al		
11.	i) Unde ii) Mode iii) Descr iv) Apply Lab Content No.	romes (erstand t el batter ribe the y the co Title To Sim	COs): On successful the modeling of vehic ry electric vehicles. drive train character oncepts of energy man	completion of this course, ele performance parameter istics. nagement system.	s. ΓLAB.		COs	ered
11.	i) Under ii) Mode iii) Description iv) Apply Lab Content No. 1	romes ((erstand t el batter ribe the y the co Title To Sim	COs): On successful the modeling of vehic ry electric vehicles. drive train character oncepts of energy man nulate the battery elect	completion of this course, ele performance parameter istics. nagement system.	s. ΓLAB. e by using]	MATLAB.	COs	i)
11.	i) Under ii) Mode iii) Descr iv) Apply Lab Content No. 1 2 2	romes ((erstand t el batter ribe the y the co Title To Sim	COs): On successful the modeling of vehic y electric vehicles. drive train characterion oncepts of energy man nulate the battery elect nulate the Motor perfor	completion of this course, ele performance parameter istics. nagement system. etric vehicle by using MAT	s. ΓLAB. e by using]	MATLAB.	COs	i)
11.	i) Under ii) Mode iii) Descr iv) Apply Lab Content No. 1 2 2	romes (erstand t el batter ribe the y the co Title To Sim To Sim To stuc Compo	COs): On successful the modeling of vehic ry electric vehicles. drive train characterion oncepts of energy man ulate the battery elect ulate the Motor perfor ly about Modelling a onents.	completion of this course, ele performance parameter istics. nagement system. etric vehicle by using MAT	s. ΓLAB. e by using]	MATLAB.	COs	i)
11.	 i) Unde ii) Mode iii) Descr iv) Apply Lab Content No. 1 2 3 4 5 	To Sime To Stude Composition Stude To S	COs): On successful the modeling of vehic ry electric vehicles. drive train character oncepts of energy man ulate the battery elect ulate the Motor perfect ty about Modelling a onents.	completion of this course, ele performance parameter istics. nagement system. etric vehicle by using MAT prmance of electric vehicle nd Characteristics of EV/H	S. FLAB. e by using I HEV Power	MATLAB.		i) i) i)
11.	 i) Unde ii) Mode iii) Descr iv) Apply Lab Content No. 1 2 3 4 5 	To Sime To Stude To s	COs): On successful the modeling of vehic ry electric vehicles. drive train character oncepts of energy man ulate the battery elect nulate the Motor perfor ly about Modelling a onents. ly about the accelerat ly & Analysis of Elect g.	completion of this course, ele performance parameter istics. nagement system. etric vehicle by using MAT ormance of electric vehicle nd Characteristics of EV/H	S. FLAB. e by using I HEV Power	MATLAB.		i) i) i) ii)
11.	i) Unde ii) Mode iii) Descr iv) Apply Lab Content No. 1 2 3 4 5	romes (erstand t el batter ribe the y the co Title To Sim To Sim To Sim To stuc Do stuc Braking To stuc	COs): On successful the modeling of vehic ry electric vehicles. drive train characterion oncepts of energy man mulate the battery elect nulate the Motor perfor ly about Modelling a onents. ly about the accelerate ly & Analysis of Elect g. ly about energy mana	completion of this course, ele performance parameter istics. nagement system. etric vehicle by using MAT prmance of electric vehicle nd Characteristics of EV/H tion performance of a car.	S. FLAB. e by using I HEV Power /ehicles Pro	MATLAB.		i) i) i) ii) iii)

Department Electives-X Lab

2. Course Name	AdvancedHeatTransfer Laboratory	L	Т		Р	
3. Course Code		0	0		2	
. Type of	Course (use tick mark)	Core ()	PE (✓)	OE ()	
5. Pre- requisit e (if any)	•	6. Frequenc y (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total N	umber of Lectures, Tuto	rials, Practical (a	ssuming 14	weeks of o	ne semester)	
Lecture	s = 0	Tutorials = 0	Practi	ical = 28		
processes are s no mass-t Besides, hea	at may occur and be studie e modelled by similar math ransfer similarity to heat t and mass transfer must	nematical equation radiation), and it i	bintly. Study the sin the case is thus more	ving them a e of diffusion e efficient t	on and convector consider the	r, but bot tion (ther em jointly
 processes are s no mass-t Besides, heat ablation 9. Learnin i) To continue ii) To definition 10. Course i) Applore ii) Modefinition 	e modelled by similar mathematicansfer similarity to heat and the and mass transfer must be a sign fin enhanced systems and evaluate valuate valuate the and boundary layer the termine effectiveness of here and the and transfer systems. The systems and evaluate valuate valuate the and t	hematical equation radiation), and it is be jointly consider arious modes of he s, evaporators, con heory, condensation eat exchangers usion npletion of this con mechanics, thermo- tim transport system signs for heat and	bintly. Study as in the case is thus more red in some eat and mass densers and bon and boilir ing LMTD a urse, the stud odynamics, I ms and devel mass transfe	ving them a e of diffusion e efficient t cases like transfer. heat exchang. und NTU. dent will be heat transfe	part is simple on and convec to consider the evaporative co ngers. e able to: er for designin ve correlation	r, but bot tion (ther em jointly ooling an g heat an
 processes are s no mass-t s no mass-t Besides, head ablation 9. Learnin i) To co ii) To da iii) Moda iii) Asper iv) Appl 	e modelled by similar mathematical sector of the sector of	hematical equation radiation), and it is be jointly consider arious modes of he s, evaporators, con heory, condensation eat exchangers usion npletion of this con mechanics, thermo- tim transport system signs for heat and	bintly. Study as in the case is thus more red in some eat and mass densers and bon and boilir ing LMTD a urse, the stud odynamics, I ms and devel mass transfe	ving them a e of diffusion e efficient t cases like transfer. heat exchang. und NTU. dent will be heat transfe	part is simple on and convec to consider the evaporative co ngers. e able to: er for designin ve correlation	r, but bot tion (ther em jointly ooling an g heat an
 processes are s no mass-t s no mass-t Besides, head ablation 9. Learnin i) To co ii) To da iii) Moda iii) Asper iv) Appl 	e modelled by similar mathematicansfer similarity to heat and the and mass transfer must be a sign fin enhanced systems and evaluate valuate valuate the and boundary layer the termine effectiveness of here and the and transfer systems. The systems and evaluate valuate valuate the and t	hematical equation radiation), and it is be jointly consider arious modes of he s, evaporators, con heory, condensation eat exchangers usion npletion of this con mechanics, thermo- tim transport system signs for heat and	bintly. Study as in the case is thus more red in some eat and mass densers and bon and boilir ing LMTD a urse, the stud odynamics, I ms and devel mass transfe	ving them a e of diffusion e efficient t cases like transfer. heat exchang. und NTU. dent will be heat transfe	part is simple on and convec to consider the evaporative co ngers. e able to: er for designin ve correlation	r, but bot tion (ther em jointly pooling an g heat an on.
 processes are s no mass-t Besides, heat ablation 9. Learnin i) To control ii) To defiii) Applemass ii) Modefiii) Assest iv) Applemass iv) Applemass iv) Applemass iv) Applemass iv) Applemass 	e modelled by similar mathematical sector of the sector of	hematical equation radiation), and it is be jointly consider arious modes of he s, evaporators, con heory, condensation eat exchangers usion mechanics, thermo- tim transport system signs for heat and the eat exchanger appler Title	bintly. Study as in the case is thus more red in some eat and mass densers and bon and boilir ing LMTD a urse, the stud odynamics, I ms and devel mass transfe ications.	ving them a e of diffusion e efficient to cases like transfer. heat exchang. und NTU. dent will be heat transfer lop prediction er and optime	part is simple on and convec to consider the evaporative co ngers. e able to: er for designin ve correlation hize the solutio	r, but bot tion (ther em jointly pooling and g heat and on.

3	To calculate the thermal conductivity of insulating powder.	ii)
4	To calculate the thermal conductivity of given liquid (glycerin).	ii), iii)
5	To calculate the average heat transfer co-efficient of vertical cylinder under natural convection.	ii), i)
6	To calculate surface heat transfer coefficient for a pipe by forced convection and compare heat transfer coefficient for different air flow rates and heat flow rates.	ii)
7	To calculate the heat transfer coefficient experimentally and theoretically for free and forced convection and compare the theoretical temperature distribution with experimentally obtained distribution.	iii), iv)
8	To study the Boiling Heat Transfer phenomenon for pool boiling of water.	iii)
9	To conduct test on a heat pipe and compare the temperature distribution and rate of heat transfer with geometrically similar copper and stainless-steel tubes.	ii), iii)
10	To determine the value of Stefan-Boltzmann constant for radiation heat transfer.	ii), iii)
11	To measure the property of emissivity of the test plate surface at various temperatures.	ii), iii)
12	To study and compare temperature distribution, heat transfer rate, overall heat transfers co-efficient in parallel flow and counter flow heat-exchanger.	iv)

1.	Name of the De	partment- Mechanic	al Engineering				
2.	Course Name	Modeling and Simulation of Manufacturing Systems Lab	L		Т		P
3.	Course Code		0		0	2	
4.	Type of Course	(use tick mark)	Core ()	PE (√)	OE ()	
5.	Pre-requisite	Computer Aided Machine Design	6. Frequency (use tick marks)	Even	() Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Number	of Lectures, Tutorial	s, Practical (assuming	14 weel	s of one semeste	r)	1
Le	ctures = 00		Tutorials = 00		Practical = 28		
8.	Course Descrip	tion:					

The objective of this course is to give a sound knowledge of the fundamental aspects of system simulation, which is used in the analysis of complex system and finds applications in a wide range of real life situations. Modeling and Simulation of Manufacturing Systems course is concerned with the concepts of system, system modeling and simulation, has been expanded to include the details of types of models and simulation software. This course covers the mathematical and statistical models. This course provides the knowledge of random number generation and inverse transform techniques. This course also discusses the analysis of simulation data and application of simulation system in manufacturing and material handling systems.

9. Learning objectives:

- i) To learn about discrete event simulation basics.
- **ii**) To introduce modeling, simulation and optimization as it applies to the study and analysis of manufacturing systems for decision support.
- **iii**) To expose with a wide range of applications for simulation methods and models and to integrate them with their introduction to operations management.
- iv) To familiarize students with the process of analyzing different types of simulation data.

10. Course Outcomes (COs): On completion of this course, the students will be able to

- i) Develop the practical skills necessary to design, implement and analyze discrete-event simulation systems.
- **ii**) Cover the basic theory underlying discrete-event simulation methodologies in order to enable a critical understanding of simulation output in managerial environments.
- **iii)** Get comfortable in applying and analyzing the process of operations management. Build the foundations necessary to quickly adapt for future advances in simulation technology.
- iv) Build the foundations necessary to quickly adapt for future advances in simulation technology.

Sr. No.	Title	CO covered
1	Simulation of a single server system	i)
2	Simulation of 2 machine n-job system for Johnson job sequencing rules	i), ii)
3	Simulation of a multi server system with different dispatching rules	i), ii)

4	Simulation of an FMS	iii), iv)
5	Simulation of Manufacturing system for different scheduling rules	ii), iii), iv)
6	Simulation of a simple supply chain	i), iii)
7	To generate Random variates using C	iii)
8	To apply Linear programming model for an industrial scenario	i)
9	To evaluate material flow in Facilities layouts	iii), iv)
10	Simulation of manufacturing systems with different Inventory control policies	i), ii)

1. Nan	ne of the Dep	artment- Mechanical	Engineering				
2. Cou	rse Name	Gas Dynamics and Jet Propulsion Lab	L	T		Р	
3. Cou	rse Code		3	0		2	
4. Тур	e of Course (use tick mark)	Core ()	PE (✓) OE		OE ()	
5. Pre- any)		Engineering Thermodynamics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Tota	l Number of	Lectures, Tutorials,	Practical (assuming 14	weeks of	one seme	ster)	
Lecture	es = 0		Tutorials = 0	Prac	tical = 28	3	
8. Cou	rse Descriptio	on					
9. Lean i) ii ii iv 10. Cou i) ii	rning objectiv To lear To propuls To form To solv rse Outcomes Demon perform Apply propuls	ves: n about various types of vide an insight into ion systems. nulate and solve proble re problems in two-din s (COs): On completion strate the knowledge hance of a jet engine. the concepts of gas ion.	es, combustion chambe of fuels, their compositi applications of compr ems in one-dimensional mensional compressible on of this course, the stu e of major elements i dynamics for applicati	on and projection on and projection of the second s	perties ws and t npressible be able to ngine and	e flow. d calculate	the overall
ii iv	·	the knowledge of cor	nbustion in Jets. engines and aircraft pro	nulsion the	orios		
	Content	, the knowledge of jet	engines and aneralt pro	puision me	01105.		
Sr. No.	Title						COs covered
1	Tutorial on	Momentum and ene	ergy in steady flow				i)
2	Tutorial on	Effect of Mach nun	nber on compressibilit	ty			i), ii)
3		=	ough a constant area d				i), ii)
4			ugh nozzles and diff	users			i), ii)
5			ation and its solution				i), iii)
6		-	vave - entropy change	;			i), iii)
7		Rayleigh flow equa					i), iii)
8			ver and Propulsive eff	-			iii), iv)
9	Tutorial on	Rocket engine perfe	ormance - Solid and I	iquid pro	pellant ro	ockets	iii), iv)

	Course Name	Industrial Safety Engineering Lab	L	r -	Г		Р
3. (Course Code		0		0		2
4. [Type of Course	(use tick mark)	Core ()	PE (✔)		OE ()	
	Pre-requisite (if	9	6. Frequency (use	Even ()	Odd	Either	Every
	any)		tick marks)		(✔)	Sem ()	Sem (
		of Lectures, Tutorials, Pr	actical (assuming 14 wee)	
	ires = 0		Tutorials = 0	Practica	l = 28		
	Course Descript		x 1 1 0 0		1 . 1	.1	
	-		on Industrial Safety. This is			-	ety
	utions in various Learning object		Also give overview on sa	itety in fin	ishing an	d testing.	
iv	 higher levels besign, Estab system to imp i) Conduct invest preventive act j) Design complete worker satisfa 	in their profession, Safety blish, Implement maintain a prove safety. stigations on unwanted inc tion to prevent recurrence lex man machine systems action, efficiency, error fre tes (COs): On completion	n industrial Safety in metal	d working n occupati alysis and cidents. eering too ronment.	machine: on health generate ls so as to	s. and mana corrective achieve c	agement and comfort,
iv		g the concept of Safety in	e e	Festing			
iv 11. 1	 V) Understanding Lab Content 	g the concept of Safety in	Welding and Gas Cutting	Testing		Co	O vered
iv 11. 1	7) Understanding Lab Content 0.	g the concept of Safety in g the concept of Safety in	Welding and Gas Cutting Finishing, Inspection and	Testing			
iv 11. 1	7) Understanding Lab Content O. 1	g the concept of Safety in g the concept of Safety in Fitle	Welding and Gas Cutting Finishing, Inspection and		nazards an	со	vered
iv [1.]	7) Understanding Lab Content To. T 1 1 2 1	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che	Welding and Gas Cutting Finishing, Inspection and ' care of cutting tools.		nazards an	со	i)
iv [1.]	7) Understanding Lab Content To. 7 1 7 2 7 p	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che prevention.	Welding and Gas Cutting Finishing, Inspection and ' care of cutting tools. ecks for safe operation – as	sociated h	nazards an	со	i) i)
iv 11. 1	7) Understanding Lab Content To. 7 1 7 2 7 p	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che prevention.	Welding and Gas Cutting Finishing, Inspection and ' care of cutting tools.	sociated h	nazards an	со	i)
iv 11. 1	7) Understanding Lab Content 0. 7 1 7 2 7 9 3 7	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che prevention.	Welding and Gas Cutting Finishing, Inspection and ' care of cutting tools. ecks for safe operation – as	ssociated h		id id	i) i)
iv 11. 1	7) Understanding Lab Content 0. 1 1 7 2 7 p 3 7 4 7	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che prevention. To study the Zero Mechani To Study the pulleys and b	Welding and Gas Cutting Finishing, Inspection and care of cutting tools. ecks for safe operation – as ical State using case study. elts-authorized entry to ha	ssociated h	stallations	id id	i) i) ii)
iv 11. 1	7) Understanding Lab Content 0. 1 1 7 2 7 9 3 7 4 7 5 7	g the concept of Safety in g the concept of Safety in Fitle Fo Study the selection and Fo Study the periodical cheorevention. Fo study the Zero Mechani Fo Study the pulleys and be Fo Study the sprockets whe	Welding and Gas Cutting Finishing, Inspection and care of cutting tools. ecks for safe operation – as ical State using case study.	ssociated h	stallations	id id	i) i) ii) ii) ii)
iv	7) Understanding Lab Content 0. 7 1 7 2 7 9 3 7 4 7 5 7 in	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che prevention. To study the Zero Mechani To Study the pulleys and b To Study the sprockets whe installations.	Welding and Gas Cutting Finishing, Inspection and care of cutting tools. ecks for safe operation – as ical State using case study. elts-authorized entry to ha eels and chains authorized	ssociated h	stallations	id id	i) i) ii) iii) iii)
iv 11. 1	7) Understanding Lab Content 0. 7 1 7 2 7 9 3 7 4 7 5 7 in	g the concept of Safety in g the concept of Safety in Fitle Fo Study the selection and Fo Study the periodical cheorevention. Fo study the Zero Mechani Fo Study the pulleys and be Fo Study the sprockets whe	Welding and Gas Cutting Finishing, Inspection and care of cutting tools. ecks for safe operation – as ical State using case study. elts-authorized entry to ha eels and chains authorized	ssociated h	stallations	id id	i) i) ii) ii) ii)
iv 11. 1	7) Understandin Lab Content 0. 1 1 7 2 7 9 3 7 4 7 5 7 in 6 7	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che prevention. To study the Zero Mechani To Study the pulleys and b To Study the sprockets whe installations.	Welding and Gas Cutting Finishing, Inspection and care of cutting tools. ecks for safe operation – as ical State using case study. elts-authorized entry to ha eels and chains authorized	sociated h	stallations	id id	i) i) ii) iii) iii)
iv 11. 1	7) Understanding Lab Content 0. 1 1 7 2 7 9 3 7 4 7 5 7 in 6 7 7 7	g the concept of Safety in g the concept of Safety in Fitle To Study the selection and To Study the periodical che prevention. To study the Zero Mechani To Study the Zero Mechani To Study the sprockets whe installations. To study the resistances we To study the resistances we	Welding and Gas Cutting Finishing, Inspection and care of cutting tools. ecks for safe operation – as ical State using case study. elts-authorized entry to ha eels and chains authorized	zardous in entry to ha	stallations	id id	wered i) i) ii) iii) iii) iii)

9	To study the Indian Boilers Regulation-using case study.	iv)
10	To study the Health and welfare measures in engineering industry-pollution	iv)
	control in engineering industry using case study.	

2. Course Name	Sales & Marketing Lab	I	_	ŗ	Γ		
3. Course Code		0)		0		2
	Course (use tick mark)	Core ()	EAS ()	PE (✓)	OE ()	
5. Pre- requisite any)	e (if	6. Frequen marks)	cy (use tick	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Nu Lectures = 0	umber of Lectures, Tutori	als, Practical (Tutorials = 0	-		f one se cal = 28		
		1 utorials = 0		Fracu	cal = 2c)	
8. Course l	Jescription						
 iii) To de iv) To de 10. Course (i) Under ii) Under iii) Under 	n a strategy implementation velop practical concept of F velop practical concept of M Dutcomes (COs): On comp estanding the Nature and Sc estanding the Developing Sa estanding the concept and P estanding the concept of Ma mponent	Principles of Ma Marketing Mana pletion of this co ope of Sales Ma ales Training rinciples of Mar	nagement agement and F ourse, the stud anagement. nagement	Financial lents will	Manage l be able	e to:	
Sr. No.	Title					CO	s
1	To Study the Objective	s and functions	of Sales man	agement.			ered i)
1 2	To Study the Objective To Study the Designing			0			ered
	• •	g and delivering	g of sales pres	entation.			ered i)
2	To Study the Designing	g and delivering	g of sales presented of sales presented by the sales presented by th	entation.	у.		ered i) i)
2 3	To Study the DesigningTo study the evaluationTo Study the Designing	g and delivering n of sales perfor g and Administe	g of sales present mance using overing various of	entation. case stud Compens	y. sation		ered i) i) i)

7	To study the business economics and fundamental concepts using case	iii)
	study	
8	To study the marketing logistics and supply chain management using case study.	iv)
9	To study the Journal sizing transactions -using case study.	iv)
10	To study the product innovation and diffusion. Meaning and scope using case study.	iv)

1.	Name of the Depa	rtment- Mechanic	al Engineering				
2.	Course Name	Neural Networks and Fuzzy Systems Lab	L	Т		P	
3.	Course Code		0	0		2	
4. '	Type of Course (u	se tick mark)	Core ()	PE (✓)		OE ()	
	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (🖌)	Either Sem ()	Every Sem ()
7. '	Total Number of 1	Lectures, Tutorial	s, Practical (assuming 1	4 weeks	of one se	emester)	
Lec	tures = 0		Tutorials = 0	Practic	al = 28		
8.	Course Descriptio	on		-			

Basic introduction to neural networks & fuzzy logic, development and implementation. It includes; Neural versus conventional computing. Learning processes. The MLP NN, backpropagation learning algorithm. Recurrent networks. Self-organization Feature maps. Applications. Introduction to Fuzzy theory. Fuzzy Logic. Neuro-Fuzzy system in engineering

9. Learning objectives:

- i) Introduce the fundamentals of Neural Networks and its applications.
- ii) Provide an overview of deep learning and convolutional neural networks.
- iii) Gain understanding about the fundamentals of Fuzzy Logic and its applications

iv) To understand membership functions and applications.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Classify the types of neural networks.
- ii) Discuss about the applications of neural networks.
- iii) Describe the concepts of deep learning and convolutional neural networks
- iv) Compare fundamentals of classical logic and fuzzy logic concepts.
- v) Characterize the fuzzy membership functions.
- vi) Summarize the applications of fuzzy logic controllers.

11. Lab Component				
Sr. No.	Title	COs covered		
1	Learning rules and activation functions in NN	i)		
2	Development of logic using MP and Hebb neuron model	i)		

3	Development of supervised learning using NN Toolbox	ii)
4	Development and testing of perceptron NN algorithm	ii)
5	Development of ADALINE algorithm with bipolar inputs and outputs.	ii)
6	Development of auto associative network using outer product rule	iii)
7	Development of fuzzy membership functions and fuzzy set properties	iii)
8	Development of logic for fuzzy relations	iii)
9	Design of a fuzzy controller systems using fuzzy tool of MATLAB	iii)
10	Application development using NN/Fuzzy logic	iii)

1.	Name of the Depa	rtment- Mechanic	al Engineering				
2.	Course Name	Aerospace Materials Lab	L		T]	P
3.	Course Code		0		0		2
4.	Type of Course (u	se tick mark)	Core ()	PE (✓)	OE ()	Special ()	ization
5.	Pre-requisite (if any)	Engineering Mechanics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	Total Number of	Lectures, Tutorial	s, Practical (assuming 1	4 weeks	of one se	mester)	1
Le	ctures = 0		Tutorials = 0	Practio	cal = 28		

8. Course Description

To provide broad based understanding of the subject "Tribology" and its technological significance, syllabus includes the genesis of friction, the theories/laws of sliding and rolling friction and the effect of viscosity. To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems and to get knowledge about different bearing materials.

9. Learning objectives: Students undergoing this course are expected to:

- i) To study the mechanical behavior of aerospace materials.
- ii) To study the thermal behavior of aerospace materials.
- iii) To study the deformation behavior of aerospace materials.
- iv) To study the selection of materials in deferent applications of aerospace.

10. Course Outcomes (COs): On course completion students will be able to:

- i) To perform the hardness and tensile test using universal testing machine.
- ii) To understand the effect of hot and cold working process on the crystal structure of materials.
- iii) To perform the bending and impact test using universal and Charpy impact testing machine.
- iv) To understand the characteristic properties of materials that influences the selection of materials.

Sr. No.	Title	CO covered
1	Deformation behavior of hot and cold rolled steels	iii)
2	Crystalline structures and dislocations	ii)
3	Aluminum alloys and strengthening mechanisms	i)
4	Solid solutions and heat treatments	ii)
5	High-temperature creep	ii)

6	Ceramics and glasses	i)
7	Deformation behavior of polymers	iii)
8	Deformation behavior of fiber reinforced composites	iii)
9	Fractography and fracture toughness	i), ii)
10	Embrittlement and environmental effects	ii)
11	Fatigue and fatigue crack growth	iv)
12	Material selection and case studies	iv)
Laborat	ory Tests: Tension tests, hardness tests, creep tests, relaxation tests, fracture	e toughness tests,
Charpy i	mpact tests, fatigue tests, microscopy.	
	echanical and servo hydraulic test machines, Rockwell hardness testers, level mpact tester, fatigue testers, microscopes, computer data acquisition.	arm creep testers,

2. Course	Cognitive Robotics	L		Т		Р
Name	Lab					
3. Course Code		0		0		2
4. Type of C	Course (use tick mark)	Core ()		PE (✔)	OE ()	1
5. Pre-	Robotics Engineering	6. Frequency	Even	Odd (✔)	Either	Every Sem
requisite	and Its Application	(use tick	0		Sem	0
(if any)		marks)			0	
7. Total Nu	nber of Lectures, Tutoria	ls, Practical (ass	uming 1	4 weeks of one se	emester)	
Lectures = 42	2	Tutorials = 0	Practi	cal = 0		
8. 8. Course	e Description					
. Learning	AM). Also provide the deta g objectives: Students unde		-		Imaging Geo	metry.
 ii) Unde iii) Gain iv) Descr 10. Course O i) Discu ii) Illustr iii) Anal expla iv) Deve 	de brief introduction to rob- rstand the concepts of path knowledge on the robot pro- ribe the aspects of Imaging utcomes (COs): On course as about the basics of robot rate the different methods of yze the various path planni- ining about the programs us lop knowledge about simul- rate the various robot program	ot cognition and p planning algorith ogramming packa Techniques used completion stude t cognition and pe of map building an ng techniques by sed. taneous localization	berceptions. ges used in Robo ents will proception d the ro- briefing on and 1	on. I in localization an tic Applications. I be able to 1. bot simulation and about the robot's napping based tec	d execution of environment hniques and p	and baradigms.
 ii) Unde iii) Gain iv) Descr 10. Course O i) Discu ii) Illustr iii) Anal expla iv) Deve 	rstand the concepts of path knowledge on the robot pro- tibe the aspects of Imaging utcomes (COs): On course ass about the basics of robot rate the different methods of yze the various path planning about the programs us lop knowledge about simular rate the various robot programs	ot cognition and p planning algorith ogramming packa Techniques used completion stude t cognition and pe of map building an ng techniques by sed. taneous localization	berceptions. ges used in Robo ents will proception d the ro- briefing on and 1	on. I in localization an tic Applications. I be able to 1. bot simulation and about the robot's napping based tec	d execution of environment hniques and p	and baradigms.
 ii) Unde iii) Gain iv) Descr 10. Course O i) Discu ii) Illustr iii) Anal expla iv) Dever v) Elabo 	rstand the concepts of path knowledge on the robot pro- tibe the aspects of Imaging utcomes (COs): On course ass about the basics of robot rate the different methods of yze the various path planning about the programs us lop knowledge about simular rate the various robot programs	ot cognition and p planning algorith ogramming packa Techniques used completion stude t cognition and pe of map building an ng techniques by sed. taneous localization	berceptions. ges used in Robo ents will proception d the ro- briefing on and 1	on. I in localization an tic Applications. I be able to 1. bot simulation and about the robot's napping based tec	d execution of environment hniques and p on and other a	and baradigms.
 ii) Unde iii) Gain iv) Descr 10. Course O i) Discu ii) Illustr iii) Anal expla iv) Deve v) Elabo 11. Lab Cont 	rstand the concepts of path knowledge on the robot pro- tibe the aspects of Imaging utcomes (COs): On course as about the basics of robot rate the different methods of yze the various path planni- tining about the programs us lop knowledge about simul- rate the various robot programent	ot cognition and p planning algorith ogramming packa Techniques used completion stude t cognition and pe of map building an ng techniques by sed. taneous localization ramming package	berceptions. ges used in Robo ents will erception d the ro- briefing on and n s for dis	on. I in localization an tic Applications. I be able to about simulation and about the robot's mapping based tec splay, tele-operatio	d execution of environment hniques and p on and other a	and paradigms. applications. Covered
 ii) Unde iii) Gain iv) Descr 10. Course O i) Discu ii) Illustr iii) Anal expla iv) Dever v) Elabo 11. Lab Cont Sr. No. 	rstand the concepts of path knowledge on the robot pro- tibe the aspects of Imaging utcomes (COs): On course ass about the basics of robot rate the different methods of yze the various path planni- ining about the programs us lop knowledge about simul- rate the various robot progr ent Title	ot cognition and p planning algorith ogramming packa Techniques used completion stude t cognition and pe of map building an ng techniques by sed. taneous localization ramming package	berception ms. ges used in Robo ents will erception ad the ro briefing on and n s for dis	on. I in localization an tic Applications. I be able to about simulation and about the robot's mapping based tec splay, tele-operatio	d execution of environment hniques and p on and other a	and paradigms. applications. Covered
 ii) Unde iii) Gain iv) Descr 10. Course O i) Discu ii) Illustr iii) Anal expla iv) Dever v) Elabo 11. Lab Cont Sr. No. 	rstand the concepts of path knowledge on the robot pro- tibe the aspects of Imaging utcomes (COs): On course as about the basics of robot rate the different methods of yze the various path planni- ining about the programs us lop knowledge about simul- rate the various robot progr ent Title To study in detail about the	ot cognition and p planning algorith ogramming packa Techniques used completion stude t cognition and pe of map building an ng techniques by sed. taneous localization ramming package	berceptions. ges used in Robo ents will proception d the ro- briefing on and n s for dis	on. I in localization an tic Applications. I be able to about simulation and about the robot's mapping based tec splay, tele-operatio	d execution of environment hniques and p on and other a COs i i	and paradigms. pplications. Covered
 ii) Unde iii) Gain iv) Descr 10. Course O i) Discu ii) Illustr iii) Anal expla iv) Dever v) Elabo 11. Lab Cont Sr. No. 	rstand the concepts of path knowledge on the robot pro- tibe the aspects of Imaging utcomes (COs): On course ass about the basics of robot rate the different methods of yze the various path planni- ining about the programs us lop knowledge about simul- rate the various robot progr ent Title To study in detail about the To study the different typ	ot cognition and p planning algorith ogramming packa Techniques used completion stude t cognition and pe of map building and ng techniques by sed. taneous localization ramming package the Cognition and pes of map building the programs in r	berceptions. ges used in Robo ents will crception d the ro- briefing on and n s for dis l perception ng	on. I in localization an tic Applications. I be able to about simulation and about the robot's mapping based tec splay, tele-operatio	d execution of environment hniques and p on and other a COs of i i i	and paradigms. applications. Covered) i)

To study the simultaneous localization and mapping based techniques,

To study and perform robot simulation.

To study various robot programming packages for Display, tele-operation

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7

8

etc.

iv)

v)

ii)

1.	Name of the Depa	rtment- Mechani	cal Engineering				
2.	Course Name	Autonomous Vehicle Lab	L	T		Р	
3.	Course Code		0	0		2	
4.	Type of Course (u	se tick mark)	Core ()	PE (✓)		OE ()	
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0

Tutorials = 0

Practical = 28

8. Course Description

Self-driving cars have rapidly become one of the most transformative technologies to emerge. Fuelled by Deep Learning algorithms, they are continuously driving our society forward and creating new opportunities in the mobility sector.

9. Learning objectives:

- i) Introduce the fundamental aspects of Autonomous Vehicles.
- ii) Gain Knowledge about the Sensing Technology and Algorithms applied in Autonomous vehicles.
- iii) Understand the Connectivity Aspects and the issues involved in driverless cars.

iv) To learn about Autonomous vehicle technology and its biggest Challenges.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

- i) Describe the evolution of Automotive Electronics and the operation of ECUs.
- ii) Compare the different type of sensing mechanisms involved in Autonomous Vehicles.
- iii) Discuss about the use of computer vision and learning algorithms in vehicles.
- iv) Summarize the aspects of connectivity fundamentals existing in a driverless car.
- v) Identify the different levels of automation involved in an Autonomous Vehicle.
- vi) Outline the various controllers employed in vehicle actuation.

11. Lab Component

Sr. No.	Title	COs covered
1		i)
	Study of an Automobile Chassis	
2		i)
	Study of Differential Mechanism of an Automobile	
3		ii)
	Study of Multiple Clutch of an Automobile	
4		ii)
	Study of Braking System (Hydraulic / Air Brake)	
5		ii)
	Study and Demonstration of different circuit of carburetor	
6		iii)
	Checking the spark plug and setting the port and check the ignition in	
	the spark plug	

7		iii)
	Study the Electrical System of an Automobile	
8		iii)
	Study the assembly of Car Engine	

				Name of the	e Faculty	: Faculty	of Er	nginee	ering	& Te	echno	logy															
			Name of the Course : - B. Tech. Mechanical Eng	ineering with s	pecializa	tion in (Ro	botio	cs, Ma	achin	e De	sign,	Ther	mal E	Engin	eerin	g, Co	mpu	ter Er	nable	Manu	ufact	uring,					
				motive Design	and Dev	elopment,	Mec	hatro	nics,	and	Elect	ric V					•					0,					
				- B. Tech	Mechan	ical Engin	eerin	g (Re	searc	:h) [2	2021-:	22]															
											heory	/					ition	Prac	tical			Practi			al)		
Sr. No.	Semester/Year	Subject Code	Nomenclature	Theory/ Practical	Core/ AECC/ SEC/ DSE/ GE	ERP	Ľ		Cre		Pass	Midterm		_	Max	Pass	Demonstration/Presentation	Viva-voce	Max	Pass	Attendance	Project/ Laboratory Work	Mid Term Conduct/ Demonstration		0355	Overall Pass Marks	Scheme of Examinations (Theory+Internal +Practical+Oral/ Theory+Internal +Practical/ Theory+Practical
1	1st		Applied Mathematics	Theory	BSC	Core	3 (-		0 24	1 20	,		40	16										40	Theory+Internal
2	1st		Design Thinking	Theory	EAS	Core	3 (0 24	1 20	_	10	_	16										40	Theory+Internal
3	1st		Basics of Mechanical Engineering	Theory	Core	Core	3 (• •			0 24	1 20 1 20	,	_	_	16								_		40	Theory+Internal
4 5	1st 1st		Biology for Engineers Material Engineering and Technology	Theory	BSC	Core Core	3 (-			1 20	,	10	40	16										40	Theory+Internal Theory+Internal
5 6	1st		Material Engineering and Technology Metrology and Material Engineering Lab	Theory Practical	Core Core	Core	0 (24	20	, 10	10	40	10	20	20	40	16	10	10	10 3	0 6		4 40	Practical + Internal
7	1st		Workshop Technology Lab	Practical	Core	Core	0 0	-									20	_	40	16	10			0 6	-	4 40	Practical + Internal
8	1st		Engineering Graphics and Design Lab	Practical	Core	Core	0 0	-		_							20	-	40	16	10	10	10 3	0 6	-	4 40	Practical + Internal
9	1st	University Umbrella	Value Addition Course-I	Theory	VAC	DSE	2 (0 24	1 20) 10	10	40	16	20	20	-10	10	10	10				40	Theory+Internal
10	_	University Umbrella	Ability Enhancement Course-I	Theory	AEC	DSE		0 0			0 24	1 20	_	10	_	16										40	Theory+Internal
			· · · · · · · · · · · · · · · · · · ·																								
11	2nd	13030201	Applied Physics	Theory	BSC	Core	3 (0 0	3	6	0 24	1 20) 10	10	40	16										40	Theory+Internal
12	2nd	13030202	Engineering Thermodynamics	Theory	Core	Core	3 (0 0	3	6	0 24	1 20) 10	10	40	16										40	Theory+Internal
13	2nd	13030203	Advance Graphics and Design	Theory	Core	Core	2 (0 0	2	: 6	0 24	1 20) 10	10	40	16										40	Theory+Internal
14	2nd	13030204	Basics of Automobile Engineering	Theory	Core	Core	3 (0 0	3	6	0 24	1 20) 10	10	40	16										40	Theory+Internal
15		13030205	Probability and Statistics	Theory	BSC	Core	3 (0 0	3	6	0 24	1 20) 10	10	40	16										40	Theory+Internal
16	2nd	13030206	Engineering Thermodynamics Lab	Practical	Core	Core	0 (0 2	1								20	20	40	16	10	10	10 3	0 6	0 2	4 40	Practical + Internal
17		13030207	Advance Graphics and Design Lab	Practical	Core	Core	0 (-									20	20	-	16	10		10 3	0 6	~ ~	4 40	Practical + Internal
18	2nd	13030208	Basics of Automobile Engineering Lab	Practical	Core	Core	0 (-									20	20	40	16	10		10 3	0 6	-	4 40	Practical + Internal
19	-	13030209	Object Oriented Programming Lab	Practical	EAS	Core	0 (_							20	20	40	16	10	10	10 3	0 6	0 2	4 40	Practical + Internal
20	2nd	University Umbrella	Ability Enhancement Course-II	Theory	AEC	DSE	2 (0 0	2	: 6	0 24	1 20) 10	10	40	16										40	Theory+Internal
			• · · · · · · · · · · · · · · · · · · ·																								
21		13030301	Strength of Materials	Theory	Core	Core	3 (-		0 24	20	, 10	10		16								_	_	40	Theory+Internal
22 23	3rd	13030302	Engineering Mechanics	Theory	Core	Core	3 (-		0 24	1 20		10	40	16								_	_	40	Theory+Internal
23	3rd 3rd	13030303 13030304	Refrigeration & Air Conditioning	Theory Theory	DE-I DE-I	DSE DSE	3 (1 20	-	10	40 40	16 16								_	_	40	Theory+Internal Theory+Internal
24	3rd	13030304	Advanced Machining Processes Advance Automobile Engineering	Theory	DE-I DE-I	DSE	3 (0 24	1 20		10	40	16								_	_	40	Theory+Internal
25	3rd	13030305	Industrial Engineering	Theory	DE-I DE-I	DSE	3 (-			1 20			40	16										40	Theory+Internal
27	3rd	13030307	Product Design for Manufacturing	Theory	DE-I	DSE	3 (0 2	1 20	_	10	40	16										40	Theory+Internal
28	3rd	13030308	Advance Materials	Theory	DE-I	DSE	3 ($0 2^{4}$	1 20	, 10	_	40	16										40	Theory+Internal
29	3rd	13030309	Steam Power Generation	Theory	DE-II	DSE	3 (0 24	1 20) 10		40	16										40	Theory+Internal
30	3rd	13030310	Production Planning & Control	Theory	DE-II	DSE	3 (-		0 24	1 20) 10	10	40	16										40	Theory+Internal
31	3rd	13030311	Fuel & Combustion	Theory	DE-II	DSE	3 (0 24	1 20) 10		40	16										40	Theory+Internal
32	3rd	13030312	Estimation & Costing	Theory	DE-II	DSE	3 (0 24	1 20	_	_		16										40	Theory+Internal
33	3rd	13030313	Total Quality Management	Theory	DE-II	DSE	3 (0 0	3	6	0 24	1 20) 10			16										40	Theory+Internal
34	3rd	13030314	Tool Design	Theory	DE-II	DSE	3 (0 0	3	6	0 24	1 20) 10	10	40	16										40	Theory+Internal
35	3rd	13030315	Composite Materials	Theory	DE-II	DSE	3 (3	6	0 24	1 20) 10	10	40	16										40	Theory+Internal
36	3rd	13030316	Strength of Materials Lab	Practical	Core	Core	0 (_							20			16	10	10	10 3	0 6	0 2	4 40	Practical + Internal
37	3rd	13030317	Engineering Mechanics Lab	Practical	Core	Core	0 (-									20	20	40	16	10	10	10 3	0 6	-	4 40	Practical + Internal
38	3rd	13030318	Refrigeration & Air Conditioning Lab	Practical	DE-I	DSE	0 (-		_							20	20	40	16	10	10	10 3	0 6	_	4 40	Practical + Internal
39	3rd	13030319	Advanced Machining Processes Lab	Practical	DE-I	DSE	0 0			_							20	20	40	16	10		10 3	0 6	~ ~	4 40	Practical + Internal
40	_	13030320	Advance Automobile Engineering Lab	Practical	DE-I	DSE	0 (20	20	40	16	10	10	0 3	0 6	_	4 40	Practical + Internal
41	3rd	13030321	Industrial Engineering Lab	Practical	DE-I	DSE	0 (-									20	20	40	16	10	10	0 3	0 6	-	4 40	Practical + Internal
42	3rd	13030322	Product Design for Manufacturing Lab	Practical	DE-I	DSE	0 (-		_							20	20	40	16	10	10	10 3	0 6		4 40	Practical + Internal
43	3rd	13030323	Advance Materials Lab	Practical	DE-I	DSE	0 (_							20	20	40	16	10	10	0 3	0 6	-	4 40	Practical + Internal
44	3rd	13030324	Steam Power Generation Lab	Practical	DE-II	DSE	0 (0 2	1								20	20	40	16	10	10	10 3	0 6	J 2	4 40	Practical + Internal

45	2rd	40000005	Descharting Dispersion & Operator I Jack	Duration		DOF		2	1		_				20	20	40	10 1	0 1 1 (10	20	60	24 40	Desisting to between the
45 46	3rd 3rd	13030325	Production Planning & Control Lab	Practical	DE-II	-		2	1		_	_			20		40	16 1) 10	30	60	24 40	Practical + Internal
40	3rd	13030326 13030327	Fuel & Combustion Lab	Practical Practical	DE-II DE-II			-	1		_	_			20 20			16 1 16 1	0 10 0 10) 10			24 40 24 40	Practical + Internal Practical + Internal
47	3rd		Estimation & Costing Lab						1		_				20		-		•	0 10		60		
40	3rd	13030328 13030329	Total Quality Management Lab	Practical	DE-II DE-II	-			1		_				20				0 10 0 10) <u>10</u>) 10		60 60	24 40 24 40	Practical + Internal
49 50	3rd	13030329	Tool Design Lab	Practical	DE-II DE-II	-			1		_				20				0 10) 10		60	24 40	Practical + Internal
50	3rd	13030330	Composite Materials Lab Industrial Internship	Practical		-					_				20				0 10	-		60	24 40	Practical + Internal Practical + Internal
52		University Umbrella	Open Elective-I	Practical	Core OE-I				2 4 6	0 24	20	10 10) 40	16	20	20	40	10 1		5 10	30	60	24 40	
53		University Umbrella	Value Addition Course-II	Theory Theory	VAC				2 6			10 10	_	_					_			_	40	Theory+Internal Theory+Internal
55	Jiu	Oniversity Onibrelia	Value Addition Course-II	Theory	VAC	DSE	2 0	0	2 0	0 24	20		7 40	10									40	Theory+Internal
54	4th	13030401	Mechanical Machine Design	Theory	Core	Core	3 0	0 3	3 6	0 24	20	10 10	10	16									40	Theory+Internal
55	4th	13030401	Manufacturing Processes and Technology	Theory	Core			-	3 6	0 24	20	10 10				-	-					_	40	Theory+Internal
56	4th	13030402	Research Methodology	Theory	EAS			-	3 6	0 24		10 10) 40	_		-	-					_	40	Theory+Internal
57	4th	13030403	Cryogenic Engineering	Theory	DE-III				3 6	0 24		10 10) 40										40	Theory+Internal
58	4th	13030405	Computer Aided Manufacturing	Theory	DE-III				3 6	0 24	_	10 10		_		-							40	Theory+Internal
59	4th	13030406	Hydrogen and Fuel Cells	Theory	DE-III	-		-	3 6	0 24	_	10 10	_										40	Theory+Internal
60	4th	13030407	Plant Layout and Material Handling	Theory	DE-III				3 6	0 24	20	10 10) 40	_									40	Theory+Internal
61	4th	13030408	Lean enterprise & Advanced Manufacturing Technologies	Theory	DE-III			-	3 6	0 24	_	10 10		_									40	Theory+Internal
62	4th	13030409	Mechanical Vibration	Theory	DE-III				3 6			10 10) 40	_									40	Theory+Internal
63	4th	13030410	Nanomaterials	Theory	DE-III				3 6	0 24	20	10 10											40	Theory+Internal
64	4th	13030411	Fluid Power System	Theory	DE-IV				3 6	0 24	20	10 10) 40	_									40	Theory+Internal
65	4th	13030412	CNC Programming	Theory	DE-IV				3 6	0 24		10 10											40	Theory+Internal
66	4th	13030413	Chassis Design	Theory	DE-IV	DSE	3 0	0 3	3 6	0 24	20	10 10) 40	16									40	Theory+Internal
67	4th	13030414	Work Study	Theory	DE-IV			0 3	3 6	0 24	20	10 10) 40	16									40	Theory+Internal
68	4th	13030415	Supply Chain and Logistic Managements	Theory	DE-IV		3 0	0 3	3 6	0 24	20	10 10) 40	16									40	Theory+Internal
69	4th	13030416	Finite Element Methods	Theory	DE-IV			0 3	3 6	0 24	20	10 10) 40	16									40	Theory+Internal
70	4th	13030417	Biomaterials	Theory	DE-IV				3 6	0 24		10 10) 40	16									40	Theory+Internal
71	4th	13030418	Mechanical Machine Design Lab	Practical	Core	Core	0 0		1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
72	4th	13030419	Manufacturing Processes Lab	Practical	Core	Core	0 0	2 '	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
73	4th	13030420	Cryogenic Engineering Lab	Practical	DE-III	DSE	0 0	2 '	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
74	4th	13030421	Computer Aided Manufacturing Lab	Practical	DE-III	DSE	0 0	2	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
75	4th	13030422	Hydrogen and Fuel Cells Lab	Practical	DE-III	DSE	0 0	2 .	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
76	4th	13030423	Plant Layout and Material Handling Lab	Practical	DE-III	DSE	0 0	2	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
77	4th	13030424	Lean enterprise & Advanced Manufacturing Technologies Lab	Practical	DE-III	DSE	0 0	2 .	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
78	4th	13030425	Mechanical Vibration Lab	Practical	DE-III			2 .	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
79	4th	13030426	Nanomaterials Lab	Practical	DE-III	DSE	0 0	2	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
80	4th	13030427	Fluid Power System Lab	Practical	DE-IV	DSE	0 0	2	1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
81	4th	13030428	CNC Programming Lab	Practical	DE-IV	-		-	1							20			0 10		30		24 40	Practical + Internal
82	4th	13030429	Chassis Design Lab	Practical	DE-IV				1						20				0 10) 10	30	60	24 40	Practical + Internal
83	4th	13030430	Work Study Lab	Practical	DE-IV			-	1						20				0 10) 10		60	24 40	Practical + Internal
84	4th	13030431	Supply Chain and Logistic Managements Lab	Practical	DE-IV				1							20			0 10				24 40	Practical + Internal
85	4th	13030432	Finite Element Methods Lab	Practical	DE-IV				1						20				0 10	, 10		60	24 40	Practical + Internal
86	4th	13030433	Biomaterials Lab	Practical	DE-IV				1						20	20	40	16 1	0 10) 10	30	60	24 40	Practical + Internal
87	4th	University Umbrella	Open Elective-II	Theory	OE-II	DSE	4 0	0 4	4 6	0 24	20	10 10) 40	16									40	Theory+Internal
00	Cale	10000501					2 0				00	10 1	10	10										
88		13030501	Fluid Mechanics and Machines	Theory	Core				3 6			10 10	_	16									40	Theory+Internal
89	5th	13030502	Kinematics of Machines	Theory	Core				3 6	0 24		10 10	10										40	Theory+Internal
90	5th	13030503	Robotics Engineering & Applications	Theory	DE-V	-			3 6	24	20	10 10											40	Theory+Internal
91 92	5th 5th	13030504	Solar & Nuclear Power Engineering	Theory	DE-V	-			36 36	0 24	20	10 10) 40										40	Theory+Internal
92 93	5th	13030505	Rapid Manufacturing Technologies	Theory	DE-V	-			36 36	0 24		10 10											40	Theory+Internal
93 94	5th	13030506	Design for Manufacturing & Assembly	Theory	DE-V DE-V			-	36 36	0 24	20	10 10 10 10) 40										40	Theory+Internal
94 95	5th	13030507 13030508	Advance Automotive Electronics	Theory Theory	DE-V DE-V			-	3 6 3 6	0 24 0 24	20	10 10) 40) 40	16 16									40	Theory+Internal
95 96	5th	13030508	Mechatronics Systems and its Applications	,	DE-V DE-V				3 3 6	0 24		10 10	_				_					_	40	Theory+Internal
96 97	5th		Introduction to Hybrid and Electric Vehicles	Theory				-	36 36	0 24	20	10 10) 40) 40										40	Theory+Internal
97	5th	13030510 13030511	Sensors & Actuators	Theory	DE-VI DE-VI				36 36	0 24	20	10 10) 40) 40										40	Theory+Internal
98 99	5th	13030511 13030512	Design of Thermal Systems Non-Conventional Machining	Theory Theory	DE-VI DE-VI				36 36	0 24 0 24	20	10 10) 40) 40										40	Theory+Internal Theory+Internal
100	5th	13030512	Non-Conventional Machining Mechanism & Manipulator Design	Theory	DE-VI DE-VI			-	3 3 6	0 24		10 10) 40	-									40	Theory+Internal
100	5th	13030513	Engine Design	Theory	DE-VI DE-VI				3 3 6	0 24	20	10 10											40	Theory+Internal
101	5th	13030514	Sensors & Actuators	Theory	DE-VI DE-VI				3 6	0 24		10 10											40	Theory+Internal
102	5th	13030515	Battery Management System	Theory	DE-VI DE-VI			-	3 6	i0 24		10 10											40	Theory+Internal
103		13030517	Fluid Mechanics and Machines Lab	Practical	Core				2	24	20	10 10	, 40	10	20	20	40	16 1	0 10	0 10	30	60	24 40	Practical + Internal
104	0.01	10000017	I IUIU MICCHALIUS ALIU MIACHILIES LAU	FIAULUA	COLE	COLE			<u> </u>						20	20	10	10			00	50	27 40	

105 5th	13030518	King and the state of the state	Desetient	0	0		_								20 2			6 1		0 10	20	60	24	40	Desisting to be the second
105 5th		Kinematics of Machines Lab	Practical	Core DE-V	Core DSE	00		1							20 2	-	-	_		$\frac{10}{10}$	30				Practical + Internal Practical + Internal
		Robotics Engineering & Applications Lab	Practical										-				-	-	• •	0 10	30	60	_	_	
107 5th		Solar & Nuclear Power Engineering Lab	Practical	DE-V	DSE	0 0		1							20 2	-		-	-	0 10		60	_	_	Practical + Internal
108 5th		Rapid Manufacturing Technologies Lab	Practical	DE-V	DSE	0 0		1							20 2	-	_	-		0 10			_	_	Practical + Internal
109 5th		Design for Manufacturing & Assembly Lab	Practical	DE-V	DSE	0 0		1							20 2	-	_	_	_	0 10	_	60	_	_	Practical + Internal
110 5th		Advance Automotive Electronics Lab	Practical	DE-V	DSE	0 0		1							20 2	-		-	-	0 10	_		_	_	Practical + Internal
111 5th		Mechatronics Systems and its Applications Lab	Practical	DE-V	DSE	0 0		1							20 2	-	-	-	0 1	0 10	30	60	_	_	Practical + Internal
112 5th		Introduction to Hybrid and Electric Vehicles Lab	Practical	DE-V	DSE	0 0		1							20 2				0 1	0 10	30	60			Practical + Internal
113 5th	13030526	Sensors & Actuators Lab	Practical	DE-VI	DSE	0 0	2	1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
114 5th	13030527	Design of Thermal Systems Lab	Practical	DE-VI	DSE	0 0	2	1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
115 5th	13030528	Non-Conventional Machining Lab	Practical	DE-VI	DSE	0 0	2	1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
116 5th	13030529	Mechanism & Manipulator Design Lab	Practical	DE-VI	DSE	0 0	2	1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
117 5th		Engine Design Lab	Practical	DE-VI	DSE	0 0	2	1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
118 5th		Sensors & Actuators Lab	Practical	DE-VI	DSE	0 0		1							20 2	-	_		-	0 10		60	_	_	Practical + Internal
119 5th		Battery Management System Lab	Practical	DE-VI	DSE	0 0		1							20 2	-	-	-	-	0 10		60	_	_	Practical + Internal
120 5th		Industrial Training-I	Practical	Core	Core	0 0		2							20 2			_	-	0 10		_	_		Practical + Internal
	University Umbrella	Open Elective-III	Theory	OE-III	DSE	4 0		4	60	24 2	20 10) 10	40		20 2	-					- 30	- 00	27	40	Theory+Internal
	University Umbrella	Ability Enhancement Course-III	Theory	AEC	DSE		0		60		20 10					_	_		_		-			40	
TZZ JUI	University Uniblella	Ability Efinancement Course-In	meory	AEC	DSE	2 0	0	2	00	24 2	.0 10		40	10										40	Theory+Internal
122 64	12020001	Light and Mass Transfer	Th	Com	C	2 0	C C	_	60	24		10	40	10										-	Theony lateras
123 6th		Heat and Mass Transfer	Theory	Core	Core	3 0			60) 10		16										40	Theory+Internal
124 6th		Dynamics of Machines	Theory	Core	Core	3 0		3	60		20 10	_		16										40	Theory+Internal
125 6th		Pneumatics & Control	Theory	DE-VII	DSE	3 0		3	60		20 10		10	16										40	Theory+Internal
126 6th		Power Plant Engineering	Theory	DE-VII	DSE	3 0		3	60		20 10	_		16										40	Theory+Internal
127 6th		Non-Destructive Evaluation & Testing	Theory	DE-VII	DSE	3 0			60	24 2	20 10) 10	40	16										40	Theory+Internal
128 6th	13030606	Advance Tribology	Theory	DE-VII	DSE	3 0	0	3	60	24 2	20 10) 10	40	16										40	Theory+Internal
129 6th	13030607	Design of Transmission System	Theory	DE-VII	DSE	3 0	0	3	60	24 2	20 10) 10	40	16										40	Theory+Internal
130 6th	13030608	Pneumatics & Control	Theory	DE-VII	DSE	3 0	0	3	60	24 2	20 10) 10	40	16										40	Theory+Internal
131 6th	13030609	Plug-in Electric Vehicles in Smart Grid	Theory	DE-VII	DSE	30		3	60	24 2	20 10) 10	40	16										40	Theory+Internal
132 6th		Mobile Robots	Theory	DE-VIII	DSE	3 0	0	3	60	24 2	20 10) 10	40	16										40	Theory+Internal
133 6th		Computational Fluid Dynamics	Theory	DE-VIII	DSE	3 0		3	60		20 10	_	_	16			_							40	Theory+Internal
134 6th		Press Tools & Dies	Theory	DE-VIII	DOL	3 0		3	60		20 10	_	_	16										40	Theory+Internal
135 6th		Finite Element Analysis	Theory	DE-VIII	DSE	3 0		3	60		20 10		-0	16		_	_		_		-			40	Theory+Internal
136 6th		Vehicle Body Dynamics		DE-VIII DE-VIII	DSE	3 0		3	60		20 10	_							_	—	_		_	40	
			Theory			3 0		3	60				_	16 16					_	_	-		_	40	Theory+Internal
137 6th		MEMS & Micro-Systems	Theory	DE-VIII	DSE		-	-	60		20 10					_	_	_	_				<u> </u>	40	Theory+Internal
138 6th		EV Charging Infrastructure Technology	Theory	DE-VIII	DSE	3 0		3	60	24 2	20 10) 10	40	16			-			_				40	Theory+Internal
139 6th		Heat and Mass Transfer Lab	Practical	Core	Core	0 0		1							20 2		_	-	-	0 10	30	60			Practical + Internal
140 6th		Dynamics of Machines Lab	Practical	Core	Core	0 0		1							20 2		_	-	0 1	<u>)</u> 10	30	60	24	_	Practical + Internal
141 6th	13030619	Pneumatics & Control Lab	Practical	DE-VII	DSE	0 0		1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
142 6th	13030620	Power Plant Engineering Lab	Practical	DE-VII	DSE	0 0		1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
143 6th	13030621	Non-Destructive Evaluation & Testing Lab	Practical	DE-VII	DSE	0 0	2	1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
144 6th	13030622	Advance Tribology Lab	Practical	DE-VII	DSE	0 0	2	1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
145 6th	13030623	Design of Transmission System Lab	Practical	DE-VII	DSE	0 0		1							20 2	0 4		_	0 1	0 10	30	60	_		Practical + Internal
146 6th		Pneumatics & Control Lab	Practical	DE-VII	DSE	0 0		1							20 2	0 4	_	_	0 1	0 10	30	60	_	_	Practical + Internal
147 6th		Plug-in Electric Vehicles in Smart Grid Lab	Practical	DE-VII	DSE	0 0		1							20 2		_		-	0 10	30	60	_	_	Practical + Internal
148 6th		Mobile Robots Lab	Practical	DE-VIII	DOL	0 0		1							20 2		_	_	-	0 10	30	60	_	_	Practical + Internal
149 6th		Computational Fluid Dynamics Lab	Practical	DE-VIII DE-VIII	DSE	0 0									20 2			_	-	0 10	_	60	_	_	Practical + Internal
150 6th		Press Tools & Dies Lab	Practical	DE-VIII DE-VIII	DSE	0 0		1							-	-	-	_	-	0 10		60	_		Practical + Internal
150 6th				DE-VIII DE-VIII	DSE	0 0		1							20 2	-	-	_	-	0 10	30	60	24		
		Finite Element Analysis Lab	Practical					1									_		-	-	30		_	_	Practical + Internal
152 6th		Vehicle Body Dynamics Lab	Practical	DE-VIII	DSE	0 0							_		20 2	-	_	-		0 10		60	_		Practical + Internal
153 6th		MEMS & Micro-Systems Lab	Practical	DE-VIII	DSE	0 0		1							20 2					0 10	30				Practical + Internal
154 6th		EV Charging Infrastructure Technology Lab	Practical	DE-VIII	DSE	0 0		1							20 2	0 4	0 1	6 1	0 1	0 10	30	60	24	40	Practical + Internal
	University Umbrella	Open Elective-IV	Theory	OE-VI	DSE	4 0		4	60		20 10		_	16										40	Theory+Internal
156 6th	University Umbrella	Value Addition Course-III	Theory	VAC	DSE	2 0	0	2	60	24 2	20 10) 10	40	16										40	Theory+Internal
457 7.1		Automation in Manufacturing	Theory	Core	Core	3 0	0	3	60	24 2	20 10) 10	40	16										40	Theory+Internal
157 7th	13030701	Automation in Manufacturing			DSE	3 0	0	3	60	24 2	20 10) 10	40	16										40	Theory+Internal
157 7th 158 7th			Theory	DE-IX	DGL																				
	13030702	Nuclear Power Engineering	Theory Theory	DE-IX DE-IX				3	60	24 2	20 10) 10	40	16										40	
158 7th 159 7th	13030702 13030703	Nuclear Power Engineering Machine Tool Technology	Theory	DE-IX	DSE	3 0	0		60 60		_	_	_	16 16										40	Theory+Internal
158 7th 159 7th 160 7th	13030702 13030703 13030704	Nuclear Power Engineering Machine Tool Technology Recent Trends in Automotive Technology	Theory Theory	DE-IX DE-IX	DSE DSE	3 0 3 0	0	3	60 60	24 2	20 10) 10	40	16										40	Theory+Internal Theory+Internal
1587th1597th1607th1617th	13030702 13030703 13030704 13030705	Nuclear Power Engineering Machine Tool Technology Recent Trends in Automotive Technology Maintenance Engineering	Theory Theory Theory	DE-IX DE-IX DE-IX	DSE DSE DSE	3 0 3 0 3 0	0 0 0	3 3	60 60 60	24 2 24 2	20 10 20 10) 10) 10	40 40	16 16										40 40 40 40	Theory+Internal
1587th1597th1607th1617th1627th	13030702 13030703 13030704 13030705 13030706	Nuclear Power Engineering Machine Tool Technology Recent Trends in Automotive Technology Maintenance Engineering Operation Research	Theory Theory Theory Theory	DE-IX DE-IX DE-IX DE-IX	DSE DSE DSE DSE	3 0 3 0 3 0 3 0 3 0	0 0 0	3 3 3	60 60 60 60	24 2 24 2 24 2 24 2	20 10 20 10 20 10) 10) 10) 10	40 40 40	16 16 16										40 40 40 40	Theory+Internal Theory+Internal Theory+Internal
1587th1597th1607th1617th	13030702 13030703 13030704 13030705 13030706 13030707	Nuclear Power Engineering Machine Tool Technology Recent Trends in Automotive Technology Maintenance Engineering	Theory Theory Theory	DE-IX DE-IX DE-IX	DSE DSE DSE	3 0 3 0 3 0	0 0 0 0	3 3	60 60 60 60 60	24 2 24 2 24 2 24 2	20 10 20 10 20 10 20 10 20 10) 10) 10) 10) 10	40 40 40 40	16 16										40 40 40 40 40 40	Theory+Internal Theory+Internal

165 7th	13030709	Robot Operating Systems	Theory	DE-IX	DSE	3.0	0	3	60	24 2	0 10	10	40	16										40	Theory+Internal
166 7th	13030709	Modelling and Simulation of EHV	Theory	DE-IX DE-IX	DSE	3 0	-	3	60	24 2	0 10	10	40	10					-					40	Theory+Internal
167 7th	13030710	Advance Heat Transfer	Theory	DE-IX DE-X	DSE	3 0		3	60		0 10								-					40	Theory+Internal
168 7th	13030712	Modelling and Simulation of Manufacturing System	Theory	DE-X DE-X	DSE	3 0		3			0 10			_					-					40	Theory+Internal
169 7th	13030712	Gas Dynamics & Jet Propulsion	Theory	DE-X DE-X	DSE	3 0		3			0 10								-					40	Theory+Internal
170 7th	13030713			DE-X DE-X	DSE	3 0		3			0 10	_	_	_					_					40	
170 7th		Industrial Safety Engineering	Theory	DE-X DE-X	DSE	3 0		3			0 10	_	10	_		-								40	Theory+Internal
171 7th	13030715	Sales & Marketing	Theory		-		-	3			_	_	_			_					_			40	Theory+Internal
	13030716	Neural Networks and Fuzzy Systems	Theory	DE-X	DSE	3 0					0 10		_	_		_					_			40	Theory+Internal
173 7th	13030717	Aerospace Materials	Theory	DE-X	DSE	3 0		3			0 10	_	10											40	Theory+Internal
174 7th	13030718	Cognitive Robotics	Theory	DE-X	DSE	30		3			0 10	_	10											40	Theory+Internal
175 7th	13030719	Autonomous Vehicles	Theory	DE-X	DSE	30		3	60	24 2	0 10) 10	40	16			40	10	10	10 10	000	00	0.4	40	Theory+Internal
176 7th	13030720	Automation in Manufacturing Lab	Practical	Core	Core	0 0		1			_	_		_	20		40	16		10 10	_	60	_	_	Practical + Internal
177 7th	13030721	Nuclear Power Engineering Lab	Practical	DE-IX	DSE	0 0		1			_	_		_	20	_	40	16	10	10 10		60			Practical + Internal
178 7th	13030722	Machine Tool Technology Lab	Practical	DE-IX	DSE	0 0		1			_	_		_	20		40	16	10	10 10	30	60	24	40	Practical + Internal
179 7th	13030723	Recent Trends in Automotive Technology Lab	Practical	DE-IX	DSE	0 0		1			_	_		_	20		40	16	10	10 10	30	60	24	40	Practical + Internal
180 7th	13030724	Maintenance Engineering Lab	Practical	DE-IX	DSE	0 0		1								20	40	16	10	10 10		60	_		Practical + Internal
181 7th	13030725	Operation Research Lab	Practical	DE-IX	DSE	0 0		1							20		40	16		10 10	30	60	_		Practical + Internal
182 7th	13030726	Instrumentation & Control Engineering Lab	Practical	DE-IX	DSE	0 0		1							20		40	16	10	10 10	30	60			Practical + Internal
183 7th	13030727	Nano-Technology and Surface Engineering Lab	Practical	DE-IX	DSE	0 0		1								20	40	16		10 10		60	_		Practical + Internal
184 7th	13030728	Robot Operating Systems Lab	Practical	DE-IX	DSE	0 0		1								20	40	16	10	10 10	30	60			Practical + Internal
185 7th	13030729	Modelling and Simulation of EHV Lab	Practical	DE-IX	DSE	0 0		1								20	40	16	10	10 10	30	60	24	40	Practical + Internal
186 7th	13030730	Advance Heat Transfer Lab	Practical	DE-X	DSE	0 0		1								20	40	16	10	10 10	30	60	_	_	Practical + Internal
187 7th	13030731	Modelling and Simulation of Manufacturing System Lab	Practical	DE-X	DSE	0 0		1								20	40	16	10	10 10	30	60			Practical + Internal
188 7th	13030732	Gas Dynamics & Jet Propulsion Lab	Practical	DE-X	DSE	0 0									20		40	16		10 10	30	60			Practical + Internal
189 7th	13030733	Industrial Safety Engineering Lab	Practical	DE-X	DSE	0 0									_	20	40	16		10 10	30	60	24	_	Practical + Internal
190 7th	13030734	Sales & Marketing Lab	Practical	DE-X	DSE	0 0		1								20	40	16	-	10 10			_		Practical + Internal
191 7th	13030735	Neural Networks and Fuzzy Systems Lab	Practical	DE-X	DSE		2	1			_	_		_		20	40	16		10 10	30	60			Practical + Internal
192 7th 193 7th	13030736	Aerospace Materials Lab	Practical	DE-X	DSE	0 0		1								20 20	40 40	16 16	10	10 10 10 10	30	60	24		Practical + Internal
193 7th	13030737 13030738	Cognitive Robotics Lab Autonomous Vehicles Lab	Practical Practical	DE-X DE-X	DSE DSE	00		1			_	_		-		20	40	16		10 10	30	60	24		Practical + Internal Practical + Internal
195 7th	13030739	Capstone Project	Practical	Core	Core	0 0		2				-				20	40	16		10 10	30	60			Practical + Internal
196 7th	13030740	Industrial Training-II	Practical	Core	Core	0 0		2							_	20	40	16	10	10 10	_	60	_	_	Practical + Internal
197 7th	13030741										_	-	-		_	40		32		10 10			_		
																						1 120			
		Research Phase-1	Practical	Core	Core	00		10		24 2	0 10	10	40	16	40	40	00	32	20	20 20	60	120) 48	40	Practical + Internal
198 7th	University Umbrella	Value Addition Course-IV	Theory	VAC	DSE	2 0	0	2	60				40			40	00	32	20	20 20	60	120	48	40	Theory+Internal
198 7th						2 0		2	60		20 10 20 10					40	60	32	20	20 20	60	120) 48	40	
198 7th	University Umbrella University Umbrella	Value Addition Course-IV Ability Enhancement Course-IV	Theory Theory	VAC AEC	DSE DSE	2 0	0	2	60 60															40	Theory+Internal Theory+Internal
198 7th 199 7th	University Umbrella	Value Addition Course-IV	Theory	VAC	DSE	2 0	0	2	60 60							40	100	40		20 20 20 20 20 20 20 20 20 20 20 20 20 2		120		40 40 40 80	Theory+Internal
198 7th 199 7th 200 8th	University Umbrella University Umbrella 13030801	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented)	Theory Theory Practical	VAC AEC Core	DSE DSE Core	2 0 2 0	0 0 20 w	2 2 20	60 60	24 2	20 10) 10	40	16										40 40 40 80 80	Theory+Internal Theory+Internal Practical+Internal
198 7th 199 7th 200 8th 201 8th	University Umbrella University Umbrella 13030801 13030802	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented) Computer Aided Engineering	Theory Theory Practical Theory	VAC AEC Core Core	DSE DSE Core Core	2 0 2 0 4 3 0	0 0 20 w 0	2 2 20 3	60 60 60 60	24 2 7 7 24 2	20 10 20 10 20 10) 10 	40 40 40	16 16 16										 80 40 40 40 80 40 40 	Theory+Internal Theory+Internal Practical+Internal Theory+Internal
198 7th 199 7th 200 8th 201 8th 202 8th	University Umbrella University Umbrella 13030801 13030802 13030802	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented) Computer Aided Engineering Advance Fluid Mechanics	Theory Theory Practical Theory Theory	VAC AEC Core Core DE-XI	DSE DSE Core Core DSE	2 0 2 0 3 0 3 0	0 0 20 w 0 0	2 2 20 3 3	60 60 60 60 60	24 2 2 2 24 2 24 2	20 10 20 10 20 10 20 10) 10 	40 40 40 40	16 16 16 16										 80 40 40 80 80 40 40 40 40 40 40 	Theory+Internal Theory+Internal Practical+Internal Theory+Internal Theory+Internal
198 7th 199 7th 200 8th 201 8th 202 8th 203 8th	University Umbrella University Umbrella 13030801 13030802 13030802 13030802	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented) Computer Aided Engineering Advance Fluid Mechanics Energy Conservation and Management	Theory Theory Practical Theory Theory Theory	VAC AEC Core DE-XI DE-XI	DSE DSE Core DSE DSE	2 0 2 0 3 0 3 0 3 0	0 0 20 w 0 0 0	2 2 20 3 3 3	60 60 60 60 60	24 2 24 2 24 2 24 2 24 2 24 2	10 10 10 10 10 10 10 10 10 10	0 10 0 10 0 10 0 10 0 10	40 40 40 40 40	16 16 16 16 16										40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	Theory+Internal Theory+Internal Practical+Internal Theory+Internal Theory+Internal Theory+Internal
198 7th 199 7th 200 8th 201 8th 202 8th 203 8th 204 8th	University Umbrella University Umbrella 13030801 13030802 13030802 13030803	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented) Computer Aided Engineering Advance Fluid Mechanics Energy Conservation and Management Numerical and Optimization Methods	Theory Theory Practical Theory Theory Theory	VAC AEC Core DE-XI DE-XI DE-XI	DSE DSE Core DSE DSE DSE	2 0 2 0 3 0 3 0 3 0 3 0 3 0	0 0 20 w 0 0 0 0 0	2 2 20 3 3 3 3 3	60 60 60 60 60 60 60	24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2	10 10 10 10 10 10 10 10 10 10 10 10) 10 10 10 10 10 10 10 10	40 40 40 40 40 40	16 16 16 16 16 16										80 40 40 80 80 40 40 40 40 40 40 40 40 40 40	Theory+Internal Theory+Internal Practical+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal
198 7th 199 7th 200 8th 201 8th 202 8th 203 8th 204 8th	University Umbrella University Umbrella 13030801 13030802 13030802 13030803 13030803 13030804	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented) Computer Aided Engineering Advance Fluid Mechanics Energy Conservation and Management Numerical and Optimization Methods Statistics for Decision Making	Theory Theory Practical Theory Theory Theory Theory	VAC AEC Core DE-XI DE-XI DE-XI DE-XI	DSE DSE Core DSE DSE DSE DSE	2 0 2 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0	0 0 20 w 0 0 0 0 0	2 2 20 3 3 3 3 3 3 3 3	60 60 60 60 60 60 60 60	24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2	20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10) 10 10 10 10 10 10 10 10 10	40 40 40 40 40 40 40	16 16 16 16 16 16 16										80 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	Theory+Internal Theory+Internal Practical+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal
198 7th 199 7th 200 8th 201 8th 202 8th 203 8th 204 8th 205 8th	University Umbrella University Umbrella 13030801 13030802 13030802 13030803 13030803 13030804	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented) Computer Aided Engineering Advance Fluid Mechanics Energy Conservation and Management Numerical and Optimization Methods Statistics for Decision Making Advanced Design of Mechanical Systems	Theory Theory Practical Theory Theory Theory Theory Theory	VAC AEC Core DE-XI DE-XI DE-XI DE-XI DE-XI	DSE DSE Core DSE DSE DSE DSE DSE	2 0 2 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0 3 0	0 0 20 w 0 0 0 0 0 0 0	2 20 3 3 3 3 3 3 3 3 3 3	60 60 60 60 60 60 60 60 60	24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2 24 2	10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10) 10) 10) 10) 10) 10) 10) 10) 10	40 40 40 40 40 40 40 40	16 16 16 16 16 16 16 16										80 40 40 40 40 80 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	Theory+Internal Theory+Internal Practical+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal
198 7th 199 7th 200 8th 201 8th 202 8th 203 8th 204 8th 205 8th 206 8th	University Umbrella University Umbrella 13030801 13030802 13030802 13030803 13030803 13030804 13030804 13030804	Value Addition Course-IV Ability Enhancement Course-IV Industrial Internship with Project (Industrial oriented/Research oriented) Computer Aided Engineering Advance Fluid Mechanics Energy Conservation and Management Numerical and Optimization Methods Statistics for Decision Making Advanced Design of Mechanical Systems Advanced Mechanics of Solids	Theory Theory Practical Theory Theory Theory Theory Theory Theory	VAC AEC Core DE-XI DE-XI DE-XI DE-XI DE-XI DE-XI	DSE DSE Core DSE DSE DSE DSE DSE DSE	2 0 2 0 3	0 0 20 w 0 0 0 0 0 0 0 0 0 0	2 2 20 3 3 3 3 3 3 3 3 3 3 3 3 3	60 60 60 60 60 60 60 60 60 60	24 2 24 2	10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10	10 10	40 40 40 40 40 40 40 40 40	16 16 16 16 16 16 16 16										80 40	Theory+Internal Theory+Internal Practical+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal Theory+Internal
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226	8th	13030814	Advanced Composite Materials Lab	Practical	DE-XII	DSE	0 0	2	1						20	20	40	16	10	10	10	30	60	24	40	Practical + Internal
227	8th	13030815	Research Phase-II	Practical	Core	Core	0 0	0	10						40	40	80	32	20	20	20	60	120	48	80	Practical + Internal
228	8 8th	University Umbrella	Ability Enhancement Course-IV	Theory	AEC	DSE	2 0	0	2	60	24 20	10 10) 40	16											40	Theory+Internal

BSC	Basic Science Course
EAS	Engineering Applied Science
VAC	Value Added Course
DE	Department Electives
OE	Open Electives
AEC	Ability Enhancement Course