SCHEME and SYLLABUS

(I and II Semester)

for

BACHELOR OF TECHNOLOGY

in

ROBOTICS AND ARTIFICIAL INTELLIGENCE

(w.e.f. session 2021-2022)

(Choice Based Credit Scheme)

DEPARTMENT OF MECHANICAL ENGINEERING

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

The scheme and Syllabus approved in 18th BOS (UG) held on 06.08.2021; Item No. BOS/18/03

VISION

"J.C. Bose University of Science & Technology, YMCA, Faridabad aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building."

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Mechanical Engineering

VISION

"To be a centre of excellence by producing high caliber, competent and self-reliant mechanical engineers, who possess scientific temperament and would engage in activities relevant to industries with ethical values and flair to research."

MISSION

- To provide efficient engineers for global requirements by imparting quality education.
- To explore, create and develop innovations in various aspects of engineering through industries and institutions.
- To emphasize on practical skills and socially relevant technology.

ABOUT THE PROGRAMME

J C Bose University of Science & Technology, YMCA, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, was established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCAs of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized fields of engineering to meet specific technical manpower requirements of industries. Mechanical Engineering Department was started in 1969 and has been conducting 4 years B.Tech Course in Mechanical Engineering since 1997 with an intake of '60' students and subsequently, it was increased to '75' in 1999, '90' in 2004 and '120' in 2007. Students are admitted through centralized counseling conducted by State Government. Presently, the total intake for the B.Tech programme is 120 and 12 through LEET in second year. Besides UG course, it is also running M. Tech in Manufacturing Technology and Automation with an intake of 18 and PhD. All courses are duly approved by AICTE/ UGC. Both UG and PG programmes are NBA accredited. From year 2021-22 department is starting another UG program viz. B.Tech in Robotics and Artificial Intelligence with an intake of 60. The Mechanical Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has a separate building with ICT enabled class rooms, state of the art laboratories, research lab, workshops, seminar room, conference hall and departmental library. It has established Centre of Excellence with M/s Danfoss India (P) Ltd. in the area of 'Climate and Energy' and one with M/s Daikin (P) Ltd. in the field of 'Refrigeration and Air Conditioning'. It has well qualified and experienced faculty. The syllabi of UG/PG courses in Mechanical Engineering Department have been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. One semester Industrial training is mandatory for every B.Tech student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system (CBCS) allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1

To train students with practical skills and experimental practices related to core and applied areas of Mechanical Engineering to expand their knowledge horizon beyond books.

PEO-2

To enable students to design, develop and maintain mechanical equipments which are useful for the society.

PEO-3

To improve team building, team working and leadership skills of the students with high regard for ethical values and social responsibilities.

PEO- 4

To enable students to communicate effectively and demonstrate the knowledge of project management and independent research.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1) **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of engineering problems.

2) **Problem Analysis:** Identify, formulate, review literature and analyze mechanical engineering problems to design, conduct experiments, analyze data and interpret data.

3) **Design /Development of Solutions:** Design solution for mechanical engineering problems and design system component of processes that meet the desired needs with appropriate consideration for the public health and safety, and the cultural, societal and the environmental considerations.

4) **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 in mechanical engineering.

5) **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to mechanical engineering activities with an understanding of the limitations.

6) **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to mechanical engineering practice.

7) **Environment and Sustainability:** Understand the impact of the mechanical engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

8) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the mechanical engineering practice.

9) **Individual and Team Work:** Function affectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in mechanical engineering.

10) **Communication:** Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as, being able to comprehend and write affective reports and design documentation, make effective presentations in mechanical engineering.

11) **Project Management and Finance:** Demonstrate knowledge & understanding of the mechanical engineering principles 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 in mechanical engineering.

12) **Life- Long Learning:** Recognize the need for, and the preparation and ability to engage in independent research and lifelong learning in the broadest contest of technological changes in mechanical engineering.

SEMESTER WISE SUMMARY OF THE PROGRAMME

S.No.	Semester	Contact Hours	Marks	Credits
1.	I	25	650	19.5
2.	II	26	600	18.5

GRADING SCHEME

Marks %	Grade	Grade points	Category
90-100	O	10	Outstanding
80≤ marks<90	A+	9	Excellent
70≤marks< 80	A	8	Very good
60≤ marks< 70	B+	7	Good
50≤ marks< 60	B	6	Above average
45≤ marks< 50	C	5	Average
40≤marks< 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation= CGPA * 9.5

Cumulative Grade Point Average (CGPA)

A student is required to maintain a Cumulative Grade Point Average (CGPA) which is the weighted average of all the Letter Grades obtained by the student since his/ her entry into the University upto and including the latest semester and is computed as follows:

$$CGPA= \sum(C_i G_{i)} / C_i$$

Where, C_i denotes the credits assigned to i^{th} course and G_i indicates the Grade Point Equivalent to the Letter Grade obtained by the student to the i^{th} course. Provided that when a student re-appears in/ repeats a course, the new Grade will replace the earlier one in the calculation of the CGPA.

Note:

At the end of the semester (i.e. after End Semester Examination), students will be supplied a DMC indicating the grades secured in each course, Semester Grade Point Average (SGPA) and up-to-date CGPA.

B.TECH ROBOTICS AND ARTIFICIAL INTELLIGENCE

(I-II SEMESTER)

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 1st YEAR (SEMESTER – I)
ROBOTICS AND ARTIFICIAL INTELLIGENCE (2021-22)

Course Code	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
BSC-103A	Mathematics- I (Calculus and Linear Algebra)	3	1	-	4	25	75	-	100	4	BSC
ESC-101A	Basic Electrical Technology	3	1	-	4	25	75	-	100	4	ESC
BSC-102	Chemistry	3	1	-	4	25	75	-	100	4	BSC
HSMC-101	English	2	-	-	2	25	75	-	100	2	HSMC
ESC-107A	Basic Electrical Technology Laboratory	-	-	2	2	15	-	35	50	1	ESC
BSC-105	Chemistry Laboratory	-	-	3	3	15	-	35	50	1.5	BSC
HSMC-102	English Lab	-	-	2	2	15	-	35	50	1	HSMC
ESC-104	Workshop- I	-	-	4	4	30	-	70	100	2	ESC
	Total	**11**	**3**	**11**	**25**	**175**	**300**	**175**	**650**	**19.5**	

Note: Exams Duration will be as under
(a) Theory exams will be of 03 hours duration.
(b) Practical exams will be of 02 hours duration
(c) Workshop exam will be of 03 hours duration

J.C.BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 1st YEAR (SEMESTER – II)
ROBOTICS AND ARTIFICIAL INTELLIGENCE (2021-22)

Course Code	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
BSC-101A	Physics (Introduction to Electromagnetic Theory)	3	1	-	4	25	75	-	100	4	BSC
BSC-106A	Mathematics- II (Calculus, Ordinary Differential Equations and Complex Variable)	3	1	-	4	25	75	-	100	4	BSC
ESC-103	Programming for Problem solving	3	-	-	3	25	75	-	100	3	ESC
BSC-104A	Physics Electromagnetic Lab	-	-	3	3	15	-	35	50	1.5	BSC
ESC-105	Programming for Problem solving Lab	-	-	4	4	15	-	35	50	2	ESC
ESC-102	Engineering Graphics and Drawing	-	-	4	4	30	-	70	100	2	ESC
ESC-106	Workshop- II	-	-	4	4	30	-	70	100	2	ESC
	Total	**9**	**2**	**15**	**26**	**165**	**225**	**210**	**600**	**18.5**	

Note: Exams Duration will be as under
(a) Theory exams will be of 03 hours duration.
(b) Practical exams will be of 02 hours duration
(c) Workshop exam will be of 03 hours duration

BSC-103A MATHEMATICS I

(Calculus and Linear Algebra)

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 4	Sessional: 25 Marks
L T P Total	Theory: 75 Marks
3 1 0 4	Total: 100 Marks
	Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Mathematics II

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

CO2- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3- The tool of power series and Fourier series for learning advanced Engineering Mathematics.

CO4- To deal with functions of several variables that are essential in most branches of engineering.

CO5- The essential tool of matrices and linear algebra in a comprehensive manner.

Course Contents:

Unit 1

Calculus: Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. **(8)**

Unit 2

Calculus: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima. **(8)**

Unit 3

Sequences and Series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem. **(12)**

Unit 4

Multivariable Calculus (Differentiation): Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence. **(10)**

Unit 5

Matrices: Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation. **(12)**

Recommended/ Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi.
5. D. Poole, Linear Algebra: A Modern Introduction, Brooks/Cole.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

ESC-101A BASIC ELECTRICAL TECHNOLOGY

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Basic Electronics Engineering, Air Conditioning Equipments

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Analyze and solve D. C. networks by different analysis methods and theorems.

CO2- Formulate and solve complex AC single phase and three circuits.

CO3- Identify the type of electrical machines and their applications.

CO4- Introduce the components of low voltage electrical installations.

Course Contents:

Unit 1

DC Circuits: Basic definitions, Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law and its limitations, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation by mesh analysis and node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. **(10)**

Unit 2

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. **(10)**

Unit 3

Poly Phase Systems: Advantages of 3-phase systems, generation of 3-phase voltages, three phase connections (star and delta), voltage and current relations in star and delta connections, three phase powers, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method. **(7)**

Unit 4

Transformers: Magnetic Circuits, construction and working of single phase transformer, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, Auto-transformer **(7)**

Unit 5

Electrical Machines: *Induction motor***:** Construction, principle and working of a three-phase induction motor, Single-phase induction motor: Construction, principle and working, Applications

*DC machine***:** Construction, principle and working of dc motor and generator. Applications

*Synchronous machine***:** Construction, principle and working of synchronous motor and generators. Applications. **(9)**

Unit 6

Electrical Installations: Components of LT Switchgear: Fuses, MCB, ELCB, MCCB, Types of Wires, Earthing, Power factor improvement. **(7)**

Recommended/ Reference Books:

1. D. P. Kothari and, I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
4. E. Hughes, "Electrical and Electronics Technology", Pearson.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India.

Web Links:

1. **NPTL Web Course, Basic Electrical Technology,** Prof. G. D. Roy, Prof. N. K. De, Prof. T.K. Bhattacharya, IIT Kharagpur
(https://nptel.ac.in/courses/108/105/108105053/)

2. **NPTL Web Course, Electrical Machines-I,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras
(https://nptel.ac.in/courses/108/106/108106071/)

3. **NPTL Web Course, Electrical Machines-II,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras
https://nptel.ac.in/courses/108/106/108106072/

BSC-102 CHEMISTRY
(Concepts in Chemistry for Engineering)
B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Environment Science

Course Objectives:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2- Rationalise bulk properties and processes using thermodynamic considerations.

CO3- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5- List major chemical reactions that are used in the synthesis of molecules.

Course Contents:

Unit 1

Atomic and molecular structure: Schrodinger equation. Particle in aboxsolutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transitionmetal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. **(12)**

Unit 2

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering. **(9)**

Unit 3

Intermolecular forces and potential energy surfaces: Ionic, dipolar and vanDer Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces. **(5)**

Unit 4

Use of free energy in chemical equilibria: Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams. **(8)**

Unit 5

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **(6)**

Unit 6

Stereochemistry: Representations of 3 dimensional structures, structural isomers and stereo isomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism initransitional metal compounds. **(6)**

Unit 7

Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule. **(5)**

Recommended/ Reference Books:

1. University Chemistry, by B. H. Mahan.
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane.
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
5. Physical Chemistry, by P. W. Atkins.
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E.Schore.

HSMC-101 ENGLISH

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 2
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Nil

Course Contents:

Unit 1

Vocabulary Building: The concept of Word Formation; Root words from foreign languages and their use in English; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms, antonyms, and standard abbreviations.

Unit 2

Basic Writing Skills: Sentence Structures; Use of phrases and clauses in sentences; Importance of proper punctuation; Creating coherence; Organizing principles of paragraphs in documents; Techniques for writing precisely.

Unit 3

Identifying Common Errors in Writing: Subject-verb agreement; Noun-pronoun agreement;

Misplaced modifiers; Articles; Prepositions; Redundancies; Clichés.

Unit 4

Nature and Style of sensible Writing: Describing; Defining; Classifying; Providing examples or evidence.

Unit 5

Writing introduction and conclusion

Unit 6

Writing Practices: Comprehension; Précis Writing; Essay Writing.

ESC-107A BASIC ELECTRICAL TECHNOLOGY LABORATORY

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

Pre- Requisite: Basic Electrical Technology

Successive: Nil

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Get an exposure to common electrical components and their ratings.

CO2- Make electrical connections by wires of appropriate ratings.

CO3- Understand the usage of common electrical measuring instruments.

CO4- Understand the basic characteristics of transformers and electrical machines.

CO5- Get an exposure to the working of power electronic converters.

List of Experiments/ Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

2. Verification of network theorem in DC circuits, Thevenin's Theorem, Norton's, Theorem, Superposition Theorem etc.

3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.

4. Poly phase systems, three phase connections (star and delta), measurement of three phase power.

5. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.

6. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

7. Torque Speed Characteristic of separately excited dc motor.

8. Components of LT switchgear.

BSC-105 CHEMISTRY LABORATORY

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 1.5
L T P Total
0 0 3 3

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

Pre- Requisite: Nil

Successive: Nil

Course Objectives:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO1- Estimate rate constants of reactions from concentration of reactants/products as a function of time.

CO2- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water etc.

CO3- Synthesize a small drug molecule and analyze a salt sample.

List of Experiments (Choice of 10-12 from the following):

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Colligative properties using freezing point depression.
6. Determination of the rate constant of a reaction.
7. Determination of cell constant and conductance of solutions.
8. Potentiometry-determination of redox potentials and emfs.
9. Synthesis of a polymer/drug.

10. Saponification/ acid value of an oil.

11. Chemical analysis of a salt.

12. Lattice structures and packing of spheres.

13. Models of potential energy surfaces.

14. Chemical oscillations-Iodine clock reaction.

15. Determination of the partition coefficient of a substance between two immiscible liquids.

16. Adsorption of acetic acid by charcoal.

17. Use of the capillary viscosimeters to demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

HSMC-102 ENGLISH LAB

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 1	Sessional: 15 Marks
L T P Total	Practical: 35 Marks
0 0 2 2	Total: 50 Marks
	Duration of Exam: 2 Hours

Pre- Requisite: Nil

Successive: Nil

Course Objectives:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

List:

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Communication at Workplace.
5. Interviews.
6. Formal Presentations.

Recommended/ Reference Books:

1. Practical English Usage. Michael Swan.OUP.
2. Remedial English Grammar. F. T. Wood. acmillan.
3. On Writing Well. William Zinsser. Harper Resource Book.
4. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press.
5. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press.
6. Exercises in Spoken English. Parts. I- III CIEFL, Hyderabad. Oxford University Press.

ESC-104 WORKSHOP-I

B. Tech (Robotics and Artificial Intelligence) I Semester

No. of Credits: 2		Sessional:	30Marks
L T P Total		Practical:	70 Marks
0 0 4 4		Total :	100Marks
		Duration of Exam:	3Hours

Pre- Requisite: Nil

Successive: Workshop- II, Workshop- III, Workshop- IV, Workshop- V, Workshop- VI, Workshop- VII

PART-A

Computer Engineering Workshop

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

CO1- Acquire skills in basic engineering practice.

CO2- Have working knowledge of various equipments used in workshop.

CO3- Have hands on experience about various machines and their components.

CO4- Obtain practical skills of basic operation and working of tools used in the workshop.

List of Exercises:

1. To study and demonstrate Block diagram of Digital Computer System and explanation of each unit.
2. To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
3. To study and demonstrate primary memory and secondary memory.
4. To demonstrate Mother Board/ Main Board and its parts, Chipset, Connectors, Add On Card.
5. To study various processor (Pentium-I, II, III, DUAL Core, i-3, i-5, i-7 etc).
6. To study various types of monitors: LCD /LED/TFT/PLASMA DISPLAY& New Technologies
7. To study different printer types and their working.
8. Assembly / Installation and Maintenance of Personnel Computer Systems:

Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss

9. Introduction to computer networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.
10. Introduction to system security and network security.

PART-B
Electrical Workshop

List of Exercises:

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.
3. To study fluorescent Tube Light, Sodium Lamp and High Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster ,Water heater, Air coolers and Electric Fans etc.

9. To study soldering process with simple soldering exercises.

10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using 23/0.0076”or 40/0.0076”cable.

PART- C
Electronics Workshop

List of Exercises:

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.

2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.

3. To study and demonstrate multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.

4. To study and demonstrate Vp (peak voltage),Vpp (peak to peak voltage), Time, frequency and phase using CRO.

5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.

6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.

7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.

8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.

9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication, assembly and wave form observation.

10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

BSC-101A PHYSICS
(Introduction to Electromagnetic Theory)
B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Mathematics course with vector calculus

Successive: Nil

Course Contents:

Unit 1

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Boundary conditions of electric field and electrostatic potential, Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab. **(8)**

Unit 2

Magnetostatics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities, Magnetization and associated bound currents; Boundary conditions on Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility . **(8)**

Unit 3

Magnetic materials and Faraday's law: Ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials. Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications. **(8)**

Unit 4

Displacement current, Magnetic field due to time-dependent electric field: Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time- dependent electric field; calculating magnetic field due to changing electric fields in quasi- static approximation.

Maxwell's equation in vacuum and non-conducting medium; electromagnetic wave equation and energy in an electromagnetic field; Flow of energy and Poynting vector. **(8)**

Recommended/ Reference Books:

1. David Griffiths, Introduction to Electrodynamics
2. Halliday and Resnick, Physics
3. W. Saslow, Electricity, magnetism and light

BSC-106A MATHEMATICS II

(Calculus, Ordinary Differential Equations and Complex Variable)

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Mathematics course with vector calculus

Successive: Nil

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes (COs): At the end of the course, the student will learn:

CO1- The mathematical tools needed in evaluating multiple integrals and their usage.

CO2- The effective mathematical tools for the solutions of differential equations that model physical processes.

CO3- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Course Contents:

Unit 1

Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. **(12)**

Unit 2

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. **(8)**

Unit 3

Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties. **(10)**

Unit 4

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. **(10)**

Unit 5

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. **(10)**

Recommended/ Reference Books:

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson.

(ii) Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.

(iii) W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India.

(iv) S. L. Ross, Differential Equations, Wiley India.

(v) E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hal India.

(vi) E. L. Ince, Ordinary Differential Equations, Dover Publications.

(vii) J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc- Graw Hill.

(viii) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,.

(ix) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

ESC- 103 PROGRAMMING FOR PROBLEM SOLVING

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 3
L T P Total
3 0 0 0

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: Nil

Course Outcomes (COs): At the end of the course, the student will learn:

CO1- To formulate simple algorithms for arithmetic and logical problems.

CO2- To translate the algorithms to programs (in C language).

CO3- To test and execute the programs and correct syntax and logical errors.

CO4- To implement conditional branching, iteration and recursion.

CO5- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

CO6- To use arrays, pointers and structures to formulate algorithms and programs.

CO7- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

CO8- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Course Contents:

Unit 1

Introduction to Programming: (4)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). **(1)**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples. (**1)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code. **(2)**

Unit 2

Arithmetic expressions and precedence **(2)**

Conditional Branching and Loops **(6)**

Writing and evaluation of conditionals and consequent branching **(3)**

Iteration and loops **(3)**

Unit 3

Arrays: Arrays (1-D, 2-D), Character arrays and Strings **(6)**

Unit 4

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).**(6)**

Unit 5

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference **(5)**

Unit 6

Recursion: Recursion, as a different way of solving problems. Example Programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort. **(4-5)**

Unit 7

Structure: Structures, Defining structures and Array of Structures. **(4)**

Unit 8

Pointers

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation). **(2)**

Unit 9

File handling (only if time is available, otherwise should be done as part of the lab)

Recommended/ Reference Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. E. Balaguruswamy, Programming in ANSIC, Tata Mc Graw-Hill.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall.

BSC-104A PHYSICS ELECTROMAGNETIC LAB

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 1.5
L T P Total
0 0 3 0

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

List of Experiments:

At least 06 experiments from the following

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves
7. To study Polarization and double slit interference in microwaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan`s law of radiation and to determine Stefan's constant.
12. To determine Boltzmann constant using V-I characteristics of PN junction diode.

Note: Experiments may be added or deleted as per the availability of equipments.

Recommended/ Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.

2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers.
3. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, Springer.

ESC- 105 PROGRAMMING FOR PROBLEM SOLVING LAB

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

Course Outcomes (COs): At the end of the course, the student will learn:

CO-1 To formulate the algorithms for simple problems.

CO2- To translate given algorithms to a working and correct program.

CO3- To be able to correct syntax errors as reported by the compilers.

CO4-To be able to identify and correct logical errors encountered at run time.

CO5- To be able to write iterative as well as recursive programs.

CO6- To be able to represent data in arrays, strings and structures and manipulate them through a program.

CO7- To be able to declare pointers of different types and use them in defining self-referential structures.

CO8- To be able to create, read and write to and from simple text files.

Tutorial 1: Problem solving using computers:

Lab 1: Familiarization with programming environment.

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions.

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1 D Arrays: searching, sorting:

Lab 5: 1 D Array manipulation

Tutorial 6: 2 D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

ESC- 102 ENGINEERING GRAPHICS AND DRAWING

B. Tech (Robotics and Artificial Intelligence) II Semester

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 30 Marks
Practical: 70 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: CAD/CAM

Course Objectives:

The objective of studying this course is to understand the basic principles of engineering drawing and graphics and to apply the same to daw different types of projections.

Course Outcomes: At the end of the course, the student shall be able to:

CO 1- Understand the basic principles of projections of points and lines.

CO 2- Know the different orientations and projections of planes and solids.

CO 3- Learn about the projections of sectioning of solids in different orientations and development of surfaces.

CO 4- Draw orthographic and isometric view of an object.

CO 5- Learn about the basics of AUTOCAD

Course Contents:

Unit 1:

Introduction: Importance, Significance and scope of Engineering Drawing, Usage of drawing Instruments, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic projections of simple engineering objects, B.I.S Specifications. **(12)**

Unit 2:

Projection of Points & Lines: Introduction of plane of projection, reference & auxiliary planes, projection of points and line in different quadrants, traces, inclinations & true lengths of the lines, projections on auxiliary plane, shortest distance intersecting and non intersecting lines. **(8)**

Unit 3:

Projection of Planes and Solids: Parallel to one reference plane, inclined to one plane but perpendicular to the other, inclined to both reference planes. Projection of Polyhedra, solids of

revolution-in simple positions with axis perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined to the other. **(8)**

Unit 4:

Sectioning of Solids and Development of Surfaces: Projections of sections of prisms, pyramids, cylinders and cones. Development of simple object with and without sectioning. **(4)**

Unit 5:

Isometric Projections: Introduction, isometric scale, Isometric view of plane figures, prisms, pyramids and cylinders. **(4)**

Unit 6:

Overview of Computer Graphics: Introduction to AUTOCAD and practice of simple exercises related to the above units on CAD Software. **(8)**

Recommended/ Reference Books:

1. Machine Drawing - N D Bhatt and V M Panchal, Charotar Publishing House.

2. A Text Book of Machine Drawing - P S Gill Pub.: S K Kataria & Sons.

3. A Text Book of Engineering Drawing and Machine Drawing by M. L. Aggarwal and Sandhya Dixit: Dhanpat Rai & Co.

4. Textbook on Engineering Drawing , K. L. Narayana and P. Kannaiah, Scitech Publichers

Web Links:

S.N	Address of web source	Content
1.	https://youtu.be/2C8H2rIwhrA	Engineering Drawing
2.	https://youtu.be/xzi_R8lims0	Drawing Layouts

ESC-106 WORK SHOP-II

B. Tech (Robotics and Artificial Intelligence) II Semester

MECHANICAL ENGINEERING WORKSHOP

No. of Credits: 2	Sessional: 30Marks
L T P Total	Practical: 70 Marks
0 0 4 4	Total : 100Marks
	Duration of Exam: 3 Hours

Pre- Requisite: Workshop -I

Successive: Workshop- III, Workshop- IV, Workshop- V, Workshop- VI, Workshop- VII

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Acquire skills on basic engineering materials and safety aspects.

CO 2- Understand the fundamental concept of various basic engineering practices namely fitting, sheet metal, carpentry, pattern making and welding etc.

CO 3- Learn and use different marking & measuring instruments used in machine shop, fitting shop, sheet metal shop, carpentry & pattern making shop etc.

CO 4- Practice real time job preparation using various operations related to fitting, sheet metal, carpentry, welding & foundry etc.

List of Exercises:

Machine shop, fitting shop, sheet metal shop, carpentry & pattern making shop, welding shop, foundry shop, forging (smith) shop and injection moulding shop.

Section (A): Machine Shop

1. To understand the layout, safety measures and fundamental concept of different engineering materials used in the workshop.
2. To study and demonstrate the various parts, specifications & operations on lathe, milling and shaping machine.
3. To study different types of measuring tools used in metrology and determine the least count of vernier calipers, vernier height gauges and micrometers.

Section (B): Fitting & Sheet Metal Shop

4. To study different types of tools, equipments, devices and machines used in fitting shop.
5. To prepare a job involving filing, drilling, tapping and hacksaw cutting operations on mild steel plate.
6. To study various types of sheet metal tools and prepare a simple sheet metal joint.

Section (C): Carpentry and Pattern Making Shop

7. To study various types of carpentry and pattern making tools and equipments.
8. To prepare a simple wooden joint (cross lap / Tee-lap/dovetail joint) using kail wood in carpentry shop.
9. To prepare single piece pattern / split pattern using kail wood in pattern making shop.

Section (D): Welding Shop

10. To practice striking an arc and prepare straight short bead on given M.S plate in flat positionby arc welding.
11. To prepare straight continuous bead and re start of electrode in flat position by arc welding on given M.S. plate as per size.
12. To practice tack weld &close butt joint in flat position by arc welding on given M.S. plate as per size.

Section (E): Foundry, Forging (Smithy) & Injection Moulding shop

13. To study various types of foundry tools and prepare a mould cavity using single/split pattern in moulding sand.
14. To study various types of forging / black smithy tools and prepare a ring or hook by hand forging operation.
15. To study the working of injection molding machine and prepare a simple component by injection moulding.

NOTE: - Total twelve exercises should be performed from the above list. At least two from each section and remaining two may either be performed from above list or designed by the concerned institution as per the scope of the syllabus and facilities available in institute.