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





Masters of Computer Application

Scheme & Syllabus (2021-22 Onwards)

Vision of SGT University

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

Semester	1st
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S. No.	Subject Code	Subject Name	L	Т	Р	С	Internal	External	Total
1		Problem Solving and Programming with C++(OOPS)	3	0	0	3	40	60	100
2		Software Testing	3	0	0	3	40	60	100
3		Advanced Database Management System	3	0	0	3	40	60	100
4		Department Electives-1	3	0	0	3	40	60	100
5		Networking technologies	3	0	0	3	40	60	100
6		Problem Solving and Programming with C++(OOPS) Lab	0	0	2	1	60	40	100
7		Software Testing Lab	0	0	2	1	60	40	100
8		Networking technologies Lab	0	0	2	1	60	40	100
9		Advanced DataBase Management System Lab	0	0	2	1	60	40	100
10		Department Electives-1 Lab	0	0	2	1	60	40	100
11		Value Addition Course-I	2	0	0	2	40	60	100
		Total	17	0	10	22			

	Semester 2nd												
S. No.	Subject Code	Subject Name	L	Т	Р	С	Internal	External	Total				
1		Computer Organization & Architecture	3	0	0	3	40	60	100				
2		Advanced JAVA	3	0	0	3	40	60	100				
3		OE-I	4	0	0	4	40	60	100				
4		Medical image processing	3	0	0	3	40	60	100				
5		Advanced Operating System	3	0	0	3	40	60	100				
6		Data Structures & Algorithm Design	3	0	0	3	40	60	100				
7		Advanced Operating System Lab	0	0	2	1	60	40	100				
8		Advanced JAVA Lab	0	0	2	1	60	40	100				
9		Data Structures & Algorithm Design Lab	0	0	2	1	60	40	100				
		Total	19	0	6	22							

Semester 3rd											
S. No.	Subject Code	Subject Name	L	Т	Р	С	Internal	External	Total		
1		Programming in Python	2	0	0	2	40	60	100		
2		Research Methodology	3	0	0	3	40	60	100		
3		Department Electives-II	3	0	0	3	40	60	100		
4		OE-II	4	0	0	4	40	60	100		
5		Mobile App Development	3	0	0	3	40	60	100		
6		Programming in Python Lab	0	0	4	2	60	40	100		
7		Department Electives-II Lab	0	0	2	1	60	40	100		
8		Mobile App Development Lab	0	0	2	1	60	40	100		
9		Value Addition Course-II	2	0	0	2	40	60	100		
		Total	17	0	8	21					

Semester	4th(A)
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S. No.	Subject Code	Subject Name	L	Т	Р	С	Internal	External	Total
1		Department Electives-III	3	0	0	3	40	60	100
2		Embedded systems in Medicine	3	0	0	3	40	60	100
3		Department Electives-III Lab	0	0	2	1	60	40	100
4		Dissertation	0	0	4	2	100	100	200
		Total	6	0	8	10			

Semester 4th(B)										
S. No.	Subject Code	Subject Name	L	Т	Р	С	Internal	External	Total	
1		Internship	0	0	0	10	100	100	200	
		Total	0	0	0	10				

MCA

Semester I

	Problem Solving and	Programming with C	++(OOP	S)		
1. Name of the Depa	artment- Computer S	cience & Engineering				
2. Course Name	Problem Solving	L	Т	T P		
	and Programming					
	with C++(OOPS)					
3. Course Code		3	0		0	
4. Type of Course (use tick mark)	Core (✓)	PE()		OE ()	
5. Pre-requisite	Programming in 'C'	6. Frequency (use	Even	Odd	Either	Every
(if any)		tick marks)			Sem ()	Sem ()
				(•)	~ ()	~ ()
7 Total Number of	Lacturas Tutarials 1	Practical (accuming 17	wooks	f one ser	noster)	
$\frac{7.101a1}{1000} = 36$	Lectures, rutoriais, r	Tutorials – 0	Practic	$\frac{1}{2} = 0$	nester)	
Lectures = 50		1 utor fais $= 0$	Tach	ai – v		
8. Course Description	0 n					
This course introduce	es the concepts of obje	ct-oriented programmin	g to stud	ents with	n a backgi	ound in
the procedural paradi	igm. The course begin	s with a brief review o	of control	structur	es and da	ta types
with emphasis on stru	ictured data types and	array processing. It the	n moves o	on to intr	oduce the	object-
oriented programmin	ng paradigm, focusing	g on the definition an	nd use o	f classes	along v	vith the
fundamentals of obje	ct-oriented design. Ot	her topics include an o	verview	of progra	amming la	anguage
principles, simple a	nalysis of algorithms	, basic searching and	sorting	techniqu	ies, even	t-driven
programming, memor	ry management and an	introduction to softwar	e enginee	ering issu	les.	
9 Learning objectiv	ves.					
1 To develop progr	amming skills of stude	nts using object oriente	ed nrogra	mming c	oncepts	
2. To learn the cond	cept of class and object	t using $C++$ and develop	o classes	for simpl	le applicat	tions.
3. To Identify impo	rtance of object orient	ed programming and d	ifference	between	structure	d
oriented and obje	ct oriented programmi	ng features.				
10. Course Outcome	$rac{1-\varepsilon}{cs}$ (COs):	0				
1. Implement, test ar	nd debug solutions in C	2++.				
2. Identify the relativ	ve merits of different al	lgorithmic designs.				
3. Apply good progr	amming style and unde	erstand the impact of st	yle on de	veloping	and main	taining
programs.						
4. Design object orie	ented solutions for small	ll systems involving mu	ıltiple obj	jects.		
11. Unit wise detaile	d content	1				
Unit-1	Number of					
	lectures = 9					
					1.1	
Problem Solving Co	ncepts: General Proble	em Solving Concepts-T	ypes of p	roblems,	problems	5
solving with compute	ers, difficulties with pro	oblem solving, Problem	Solving	Aspects,	Problem	Solving
Concepts for compute	er- constants and varial	bles, data types, functio	ns, opera	tors, exp	ressions a	nd
equations.						
1						

Unit – 2	Number of	
	lectures = 9	

Foundations of Object Oriented Programming :Introduction to procedural, modular, objectoriented and generic programming techniques, Limitations of procedural programming, Need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism.

Extensions to C : Variable declarations, global scope, 'const', reference variables, operators in C++(scope resolution, new , delete), dynamic memory allocation, function prototypes, default and constant arguments, 'cin', 'cout', inline functions

Class: Defining a class, data members and member functions, public, private and protected members, inline member functions, static data members, static member functions, constructors, destructors, array of objects, classes, objects and memory, class as ADTs and code reuse

Unit – 3	Number of
	lectures = 09

Overloading and Inheritance: Function overloading, friend function, friend class Operator Overloading : Introduction, Need of operator overloading, rules for operator overloading, overloading the unary and binary operators using member function, operator overloading using friend function, overloading relational and logical operators, overloading new, delete and assignment operator, type conversions Inheritance : Introduction, Need of inheritance, base and derived classes, member access control, types of inheritance, derived class constructor, constructors in multiple inheritance, overriding member functions, ambiguity in multiple inheritance, virtual base class Virtual functions : Pointers to objects, 'this' pointer, Pointers to derived class, virtual function, rules for virtual function, pure virtual function, abstract class, virtual destructors, early and late binding, container classes,

Unit – 4	Number of	
	lectures = 9	

Templates, Exception Handling and File I/O: Namespaces: Introduction, Rules of namespaces, Templates : Introduction, Function template and class template, overloading function template, member function templates and template arguments Exception Handling: Introduction, Exception handling mechanism: try, catch and throw, Multiple Exceptions, Exceptions with arguments Managing Console I/O Operations: Introduction, C++ streams, stream classes, unformatted I/O, formatted I/O and I/O manipulators File I/O: Introduction, Classes for file stream operations, file operations (open, close, read, write, detect end of file), file modes, File pointers and their manipulations, error handling during file operations

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/course-category/OOPS

13. Books Recommended

Text Books

• Programming and Problem Solving with C++ By Nell B. Dale, Chip Weems, 6th edition Jones & Bartlett Publishers, 2014

Reference Books

- "Problem Solving with C++ " by Walter Savitch Sixth Edition Pearson/Addison-Wesley, 2007
- Programming with C++ by John R. Hubbard, Atul Kahate, 3rd Edition, schaums series 2009

Semester I

SOFTWARE TESTI	NG	
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1. Name of the Depa	artment- Computer S	cience & Engineering					
2. Course Name	SOFTWARE TESTING	L	Т		Р		
3. Course Code		3	0		0		
4. Type of Course (use tick mark)	Core (√)	PE ()		OE ()		
5. Pre-requisite	Software	6. Frequency (use	Even	Odd	Either	Every	
(if any)	Engineering	tick marks)			Sem ()	Sem ()	
				(•)			
7. Total Number of	Lectures, Tutorials, I	Practical (assuming 12	weeks o	f one ser	nester)		
Lectures = 36		Tutorials = 0	Practic	al = 0			
8. Course Description	0 n						
 I his course will e Emerging conce Students will gain 9. Learning objective	pts such as test-case pr n hands-on testing/anal	oftware testing and rela ioritization and their im lysis experience via a m	ted progr pact on to ulti-phase	am analy esting wi e course	ill be exar project.	nined.	
 Appreciate the function of the second second	ndamentals of softward designing and executin e. appreciate the role of so uing interest in softwar	e testing and its applicang software tests suitables of tware testing in system re testing, and obtain sat	e for diffension throu e for diffension ns develo tisfaction	ign the s erent stag pment, c from its	oftware in ges in the leploymen study and	nt and	
10. Course Outcome	es (COs):	and knowledge of softw	oro tostin	a and Da	bugging	and tast	
cases.	ge of basic principles a	ind knowledge of softw	are testin	g and De	ougging	and test	
2. Understand the p	erceptions on testing li	ke levels of testing, gen	eralized p	pseudo c	ode and w	vith	
related examples	types of testing						
4 Analyze the diffe	rence between function	nal testing and structura	l testing				
4. Thatyze the diffe		in testing and siructura	i testing.				
11. Unit wise detaile	d content						
Unit-1	Number of						
	lectures = 9						
Introduction: What Failure, Incident, Te Cycle Model, No abs Verification Testin Verification, Code Re Functional Testing: Testing, Cause Effect Structural Testing: Cyclomatic Complex	is software testing and est Cases, Testing Pro- olute proof of correctn g: Verification Meth eviews, User Documen Boundary Value Ana to Graphing Technique. Identification of In- sity, Graph Matrix C	why it is so hard?, Som cess, Limitations of T ess, Overview of Graph ods, SRS Verificatio tation Verification, Sof lysis, Equivalence Clas dependent Paths: Co	ne Softwa Sesting, V Theory. n, Software Pros tware Pros tware Pros tware Software tware Software ntrol Flo	re Failur / Shapec / Shapec // Shape	res, Error, l Softwar sign Doc lits. on Table ph, DD-l og, Slice	Fault, re Life cument Based Paths, Based	
Testing, Mutation tes	Testing, Mutation testing.						

Unit – 2	Number of	
	lectures = 9	

Use Case Testing: Use Case Diagrams and Use Cases, Generation of Test Cases from Use Cases, Applicability. Validity Checks: Strategy for Data Validity, Guidelines for Generating Validity Checks. Database testing. Selection, Minimization

Prioritization of test cases for Regression Testing: Regression Testing, Regression Test Case Selection, Prioritization guidelines, Priority category Scheme, Code Coverage Techniques for Prioritization of Test Cases, Risk Analysis.

Unit – 3	Number of	
	lectures = 09	

Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging Object Oriented Testing: Issues in Object Oriented Testing, Path testing, Class Testing, state based testing, Object Oriented Integration and System Testing.

Metrics and Models in Software Testing: What are Software Metrics, categories of Metrics, object Oriented Metrics used in testing, What should we measure during testing?, Software Quality Attributes.

Prediction Model: Reliability Modes, Fault Prediction Model.

Unit – 4	Number of			
	lectures = 9			

Test Management and Automation

Test Planning, Management, Execution and Reporting, Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection, Testing in Object Oriented Systems.

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.

13. Books Recommended

Text Books

• Effective Methods for Software Testing, William Perry, John Wiley & Sons, New York, Van Nostrand Reinhold, New York, 2nd Ed., 2006.

Reference Books

- Software Testing A Craftsman"s approach, Paul C. Jorgenson, CRC Press.
- Testing Computer Software, Cem Kaner, Jack Falk, Nguyen Quoc, Van Nostrand Reinhold, New York, 2nd Ed.
- Foundation of Software Testing, Aditya P. Mathur, Pearson, 2008.
- Software Engineering A Practitioner^{**}s Approach, Roger S. Pressman, McGraw-Hill International Edition, New Delhi, 5th Ed..
- Software Engineering, K. K. Aggarwal & Yogesh Singh, New Age International Publishers, New Delhi, 3rd Ed.

Semester I

Advanced Database management System						
Nai	me of the Departm	ent- Computer Science	& Engineering			
Course Name	Advanced	L	Т	Р		
	Database					
	management					
	System					
Course Code		3	0	0		
Type of Course (u	ise tick mark)	Core (🖌)	PE()	OE ()		
Prerequisite (if any)	DBMS	Frequency (use tick	Even Odd (Either Every		
		marks)	0 🖌	Sem () Sem ()		
Total Number	of Lectures, Tutori	als, Practical (assuming	g 12weeks of one	semester)		
Lectures	= 36	Tutorials = 0	Practi	cal = 0		
Course Description						
This module aims	to give students in d	epth information about s	system implementa	tion techniques,		
data storage, repres	senting data element	ts, database system archi	tecture, the system	catalog, query		
processing and opt	imization. transaction	on processing concepts.	concurrency contro	ol		
techniques, databas	se recovery techniqu	les.	j			
Learning objectives:	j j					
1. To understa	and the basic concer	ots and terminology relat	ed to DBMS and F	Relational		
Database Design						
2. To the design	2 To the design and implement Distributed Databases					
3 To understa	and advanced DBM	S techniques to construct	tables and write e	ffective queries		
forms and	reports	s teeninques to construct		neenve quenes,		
iornis, and	reports					
Course Outcomes (CO	Os):					
1. Exposure fo	r students to write c	omplex queries includin	g full outer joins, s	elf-ioin, sub		
queries, and	l set theoretic querie	28.	8 , J, -	J, ~		
2. Know how	of the file organizati	on, Query Optimization,	Transaction mana	gement, and		
database ad	ministration technic	jues		8,		
		1				
Unit wise detailed cor	itent					
Unit-1	Number of					
	lectures $= 9$					
Formal review of r	elational database a	nd FDs Implication Clos	sure its correctnes	\$		
3NF and BCNF. D	ecomposition and sy	vnthesis approaches Basi	cs of query proces	sing external		
sorting, file scans.	composition and s.	, infloors upprouenes, Dusi		sing, enternar		
sorting, me seans.						
Unit – 2	Number of					
	lectures = 9					
Processing of joins	, materialized vs. pi	pelined processing, quer	y transformation r	ules, DB		
transactions, ACID	properties, interlea	ved executions, schedule	es, serializability			
Unit – 3	Number of					
	lectures = 9					
Correctness of inte	rleaved execution, I	Locking and managemen	t of locks, 2PL, de	adlocks,		
multiple level granularity, CC on B+ trees, Optimistic CC						
$\frac{1}{1}$ Unit – 4	Unit – 4 Number of					
	lectures = 9					
Time stamped, loc	k based techniques,	Multiversion approaches	, Comparison of C	C methods,		
dynamic databases, Failure classification, recovery algorithm, XML and relational databases						

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/course-category/

Books Recommended

Text Books

R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004

A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.

Reference Books

K. V. Iyer, Lecture notes available as PDF file for classroom use.

Semester I

Networking technologies						
2. Course Name	Networking	L	T	I	•	
	technologies					
3. Course Code		3	0	2	2	
4. Type of Course	(use tick mark)	Core $()$	PE()	Ol	E()	
5. Pre-requisite (if		6. Frequency (use	Even O	dd Either	Every	
any)		tick marks)	(1)	$\forall) \qquad \mathbf{Sem}()$	Sem ()	
7. Total Number	of Lectures. Tuto	rials. Practical (assumir	ng 12 weeks o	of one semeste	er)	
Lectures	= 36	Tutorials = 0	Pr	actical = 24		
Course Description:						
The structure a	nd components of co	omputer networks, packe	t switching, la	ayered archited	ctures,	
TCP/IP, physic	al layer, error contro	ol, window flow control,	local area net	tworks (Etherr	net,	
Token Ring; FDDI), network layer, congestion control, quality of service, multicast						
Learning objectives:						
1. Discuss the evo	olution of computer	network concepts.				
2. Understand the	structure of comput	er networks, factors affe	cting compute	er network		
deployment.						
3. Describe emerg	ging technology in the	he net-centric computing	area and asse	ess their curren	nt	
capabilities, lin	nitations and potenti	al applications.		с. · · ·	1	
4. Program and ar	alyse network proto	ocols, architecture, algori	thms and othe	er safety critic	al	
issues in real-in	le scenario.					
Course Outcomes:						
1. Examine and an	nalyze various proto	cols like transport-layer	concepts: Tra	nsport-Layer s	services	
2Reliable vs. ur	n-reliable data transf	er -TCP protocol -UDP	protocol			
3. Examine and an	nalyze the network-	layer concepts like Netw	ork-Layer ser	vices –Routing	g -IP	
protocol -IP ad	dressing					
4. Examine and an	halyze the different	link-layer and local area	network conc	epts like Link	-Layer	
services – Ether	net -Token Ring -E	rror detection and correc	tion -ARP pro	otocol		
5. Analyze and in	plement application	n of network system.				
11. Unit wise detailed	content					
Unit-1	Number of	Title of the unit: Intro	duction Con	cepts		
Cools and Annliastica		rouls at mastering and anothit	sture The Of	CI vofovovo v	a dal	
Sorvices Network Ten	ology Design Dale	VOIK Structure and archite	Design Local	Access Notw	ork	
Design Physical Lave	r Transmission Med	is Switching methods I	SDN Termin	al Handling	01K	
Design, i nysicai Layel		ia, Switching methods, I		ai Handing.		
Unit - 2	Number of	Title of the unit: Medi	ium Access si	ub laver		
	lectures = 8			un iuj ci		

Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

Unit - 3Number of lectures = 8Title of the unit: Network Layer	it - 3	Number of lectures = 8	Title of the unit: Network Layer
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Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking -TCP / IP, IP packet, IP address, IPv6.

Unit - 4	Number of	Title of the unit: Transport Layer
	lectures = 8	

Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management. Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. Example Networks- Internet and Public Networks.

11. 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/course-category/

13. Text Books Recommended

Reference Books

- I. —Data Communication and Networkingl by B. A. Forouzen, TMH, 4th Edition, 2017
- II. Computer Networks, A.S. Tanenbaum, Pearson Education, 5th Edition, 2013
- III. Data and Computer Communication, W. Stallings, Pearson Education, 10th Edition, 2013
- IV. Essential of TCP/ IPI G. Shanmugarathinam, Firewall Media, 2008

Droh	Nom Solving and P	Semester I	(OOPS)]	[oh		
1 Name of the D	enartment. Comp	iter Science & Enginee	ring			
2. Course Name	Problem		T		Р	
2. Course Maine	Solving and		T		1	
	Programming					
	with					
	$C \pm \pm (OOPS)$					
	Lah					
3. Course Code	Lab	0	0		2	
4. Type of Course (us	se tick mark)	Core (✔)	PE()		OE ()	
5. Pre-requisite (if	Programming	6. Frequency (use	Even	Odd	Either	Everv
anv)	in 'C' & Data	tick marks)	1 , on		Sem ()	Sem ()
unyy	Structure	then murns)		(•)	Sem ()	Sem ()
7. Total Number of I	ectures. Tutorials	Practical (assuming 12	2 weeks o	of one ser	nester)	
Lectures $= 0$		Tutorials = 0	Practic	al = 48		
8. Course Description	: This lab course pro	vides in-depth coverage of	objectorie	ented prog	rammino	
principles and techni	aues using C++. Topi	cs include classes, overloa	ding. data	abstractic	on. informa	ntion
hiding, encapsulation	n, inheritance, polymo	orphism, file processing, ter	mplates, e	xceptions.	, container	classes,
and low-level langua	ige features.					
9. Learning objectiv	es:					
1. To understand f	fundamentals of prog	ramming such as variable	s, conditio	onal and i	terative ex	ecution,
methods, etc.						
2. To understand fu	undamentals of object	-oriented programming in	Java, inclu	uding defi	ning class	es,
invoking method	ls, using class librarie	s, etc				
3. To have the abili	ity to write a compute	r program to solve specifie	d problem	IS		
10. Course Outcomes ((COs):					
1. Understand the fe	eatures of C++ suppor	ting object oriented progra	mming			
2. Understand the re	elative merits of C++	as an object oriented progr	amming la	anguage		
3. Understand the fe	eatures of C++ support	ting object oriented progra	mming	domenter	overlaadi	20
4. Understand duval	letive merits of C++	specifically stream 1/0, ten	ipiates and		overioaui	iig
11 List of Experiment		as all object offended progra	anning ia	inguage		
1 Simple C + program	s na ta implamant var	ious control structures				
a if statement	lis to implement var	ious control structures.				
h switch case statement	nt and do while loor					
c for loop)				
d while loop						
u. while loop						
2 Programs to underst	and atmisture & uni	200				
2. I Togranis to underst		J115.				
a. suuciule						
	D. umon					
3 Programs to underst	and pointer arithme	tio				
	5. Frograms to understand pointer antimetic.					
1 Functions & Doorrow	ion					
4. Functions & Recurs	1011. N					
a. recursion d. function	1					
5 Inline functions						
J. mine functions.						
6 Programs to underst	and different function	on call mechanism				
0. Flogranis to underst		on can mechanisin.				
a. call by reference b. c	can by value					

7. Programs to understand storage specifiers.

8. Constructors & destructors.

9. Use of "this" pointer using class

10. Programs to implement inheritance and function overriding.

a. multiple inheritance –access Specifiers

b. hierarchical inheritance – function overriding /virtual Function

11. Programs to overload unary & binary operators as member function &non member function.

a. unary operator as member function

b. binary operator as non member function

12. Programs to understand friend function & friend Class.a. friend Function b. friend class

13. Programs on class templates

14. Using a C++ program check whether a student passed the exam or not based on total mark which shall be above 40%

15. Create a C++ program which takes two distances in an inch-feet system and stores in data members of two structure variables. Then, this program calculates the sum of two distances and displays it.

During the course student must be do project on:

- 1. Tic Tac Toe Game Project(This project will be without graphics which focus on logic /algorithm used in game. Two players can play this game.)
- 2. Supermarket Billing Project (Student can build product class with data members like product no, product name, price, qty, tax, discount. Product details is stored in a binary file. A customer can purchase a product and his invoice generated. Administrator can create, modify, view and delete product record.)
- 3. Fortune Teller Project in C++(Student can build console application which can determine the horoscope, and predict the future of user based on date of birth, name, and sex entered)
- 4. Search Engine (Student can build an academic search engine application which is designed to search relevant academic information and records in schools, colleges and universities)

At least one Project is mandatory for each student.

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

http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/index.php

		SOFTU	Semester I				
1	Name of the D	SOF I W enartment- Comm	ARE TESTING LAB	rino			
2	Course Name	SOFTWARF	L	T		Р	
		TESTINGLAB	L	1		1	
3.	Course Code		0	0		2	
4.	Type of Course (us	se tick mark)		PEO		OE ()	
				-		020	
5.	Pre-requisite (if	Software	6. Frequency (use	Even	Odd	Either	Every
	any)	Engineering	tick marks)		(√)	Sem()	Sem()
7.	Total Number of L	Lectures, Tutorials,	Practical (assuming 12	weeks o	of one ser	nester)	
Lee	ctures = 0	, ,	Tutorials = 0	Practica	al = 48	,	
8.	Course Description	n					
9.	Learning objective	s:					
	1. To apply softwar	re testing knowledge a	and engineering methods.				
	2. Have an ability t	to design and conduct	a software test process for	a software	e testing p	roject.	
	3. To identify the	needs of software test	t automation, and define a	nd develo	op a test t	ool to sup	port test
	automation.				•		
	4. Have an ability u	understand and identif	y various software testing	problems,	and solve	these pro	blems by
	designing and se	electing software test n	nodels, criteria, strategies,	and metho	ods.		
	5. Have basic unde	erstanding and knowl	edge of contemporary issu	ies in sof	tware test	ing, such	as
	component-base	d software testing pro	olems				
4.0	6. To use software	testing methods and n	nodern software testing too	ls for the	r testing p	rojects.	
10.	Course Outcomes	(COs):					
	I. Understand fundation	amental concepts in s	oftware testing, including	software	testing ol	ojectives,	process,
	criteria, strategie	es, and methods.	1	1 1 1	1	.1 1 .	
	2. Gain software te	esting experience by a	applying software testing	knowledg	ge and me	thods to p	oractice-
	2 Understand softw	e testing projects.	coblome and colution				
	1 Commohand the	vale test automation pr	offering Quality Attributes	Quality	Dlanning	Software	Quality
	4. Comprehend the Control and Soft	ware Quality Assuran	ce	, Quanty	r laining,	Software	Quality
11	L ist of Experiment						
11.	1) Write programs	s in Clanguage to de	monstrate the working	of the foll	owing co	netructer	
	i) do while	s in c language to u	monstrate the working (lowing co	mstructs.	
	i) while do						
	iii) if else						
	iv) switch						
	v) for						
	2) A program writ	tten in C language fo	or Matrix Multiplication	fails Int	rospect th	e causes	for its
	failure and writ	te down the possible	reasons for its failure	10110 1110	losp eet u		101 105
	3) Take any system	m (e.g. ATM system	and study its system st	pecificati	ons and r	eport the	various
	bugs.		i) und study its system of	Joonnouti	ons and i	epone une	vario ab
	4) Write the test c	ases for any known	application(e.g. Banking	applicat	ion)		
	5) Create a test pla	an document for any	application (e.g. Library	y Manage	ement Sv	vstem)	
	6) Study of any testing tool (e.g. Winrunner)						
	7) Study of any w	eb testing tool (e.g.	Selenium)				
8) Study of any bug tracking tool (e.g. Bugzilla, bugbit)							
	9) Study of any te	st management tool	(e.g. Test Director)				
	10) Study of any or	pen source-testing to	ol (e.g. Test Link)				
At	least one Project is	mandatory for each	student.				
12.	Brief Description of	of self-learning / E-le	arning component				
	1						

http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/index.php

Semester I

Networking technologies Lab						
13. Name of the D	epartment- Compu	iter Science & Enginee	ring			
14. Course Name	Networking	L	Т		Р	
	technologies					
	Lab	0	0			
15. Course Code		0	0		2	
16. Type of Course (u	se tick mark)	Core (✔)	PE()		OE ()	
17. Pre-requisite (if	Software	18. Frequency (use	Even	Odd	Either	Every
any)	Engineering	tick marks)		(√)	Sem()	Sem()
19. Total Number of l	Lectures, Tutorials	, Practical (assuming 1	2 weeks	of one se	mester)	1
Lectures = 0		Tutorials = 0	Practica	al = 48		
20. Course Descriptio	n					
21. Learning objectiv	es:					
1. Discuss the evo	olution of computer	network concepts.				
2. Understand the	structure of compute	r networks, factors affect	ing comp	uter netwo	ork deploy	ment.
3. Describe emerg	ing technology in the	ne net-centric computing	area and	l assess th	neir currei	nt
capabilities, lim	itations and potential	l applications.		41	:4:1 :	
4. Program and an real-life scenario	alyse network protoc	cois, architecture, algoriti	ins and o	other safet	y critical	issues in
Teal-Inc Scenario	0.					
22. Course Outcomes	(COs):					
1. Examine and a	nalyze various proto	cols like transport-layer	concepts:	Transpor	t-Layer se	ervices -
Reliable vs. un-	reliable data transfer	-TCP protocol -UDP pro	tocol	1	5	
2. Examine and an	alyze the network-la	yer concepts like Networ	rk-Layer s	services –	Routing -	IP
protocol -IP add	lressing					
3. Analyze and im	plement application	n of network system.				
23. List of Experiment	S					~
1. To learn han	dling and configurat	tion of networking hardy	vare like	RJ-45 co	nnector, (CAT-6
cable, crimping	tool, etc.			1 / \		
2. Configuratio	n of router, hub, sw	itch etc. (using real devi	ces or sin	nulators)	. 1 . 0	
3. Running and	using services/com	mands like ping, tracero	ute, nsloc	okup, arp	, telnet, ft	p, etc.
4. Network pac	ket analysis using to	ools like Wireshark, topo	lump, etc	OMNAT	L NOO	NG2
5. Network shill	iulation using tools	like Cisco Packet Tracer	, netsiin	, OMINEI	++, INS2,	, INSS,
EIC. 6 Socket progr	emming using UDP	and TCP (a.g. simple I	NNS data	& time	liont/sor	10 r
o. Socket plog	anning using ODF	und ICF (e.g., simple L	JNS, uala		liciii/sei v	/01,
7 Programmin	a using raw sockets	urrent 501 vol 5 <i>1</i>				
8 Programmin	o using RPC					
Δt least one Dr	At least one Project is mandatory for each student					
24 Brief Description of self-learning / E-learning component						
	i sen rearning / E-R	component				

		Semester I				
Name of the Departm	ant Computor So	MCA				
Name of the Departin	ient- Computer Sci	ience & Engineering	m		D	
Course Name	Advanced	L	T		P	
	Database					
	Management					
	System Lab					
Course Code		0	0		2	
Tupe of Course (use f	tial manle)					
Type of Course (use)	lick mark)					T
Pre-requisite (II		Frequency (use tick	Even	Uaa (Either	Every
any)		marks)		√)	Sem ()	Sem ()
Total Number of Lec	tures, Tutorials, P	ractical (assuming 12 w	eeks of o	ne semes	ter)	
Lectures = 0		Tutorials = 0	Practic	al = 24		
Course Description						
1. To explore the	features of a Databa	ase Management System	S			
2. To interface a c	database with front	end tools				
3. To understand	the internals of a da	tabase system				
	<u> </u>					
Course Outcomes (C	Os):					
I. Ability to use d	atabases for building	g web applications.				
2. Gaining knowl	edge about the inter	nals of a database system	1.			
3. To gain the know	owledge of PHP					
4. Ability to use I	Big data analytics.					
List of Experiments						
I. Experiments sh	nould be Project Ori	ented				
2. Basic SQL	01					
3. Intermediate S	QL					
4. Advanced SQL						
5. ER Modelling	1					
6. Database Desig	gn and Normalizatio	n · mpc				
7. Accessing Data	abases from Program	ns using JDBC				
8. Building Web	Applications using I	PHP & MySQL				
9. Indexing and C	Query Processing					
10. Query Evaluati	ion Plans					
II. Concurrency at	nd Transactions					
12. Big Data Analy	stics using Hadoop	1 .				
13. During the cou	rse student must be	do project on:	1.40	1		
14. E- Commerce I	Management (Stude	nt can build an E-comme	erce plati	orm, whe	re a custo	omer
can register and	a buy a product)	1 11 1 1 1 1	т	.1 •		
15. Inventory Man	agement (Student ca	an build a project which	can Incre	ase the in	ventory t	urnover
I for any busines	iS) wing Student Decon	de (Student een huild e e	abution th	at correct	student no	aanda
10. Solution for Sa	nal institution)	us (Studelit call Dulla à S		iat saves s	student re	corus
101 an cultational institution (areas a database solution for managing respective)						
17. Fayton Management Solution (create a database solution for managing payron) 18. At least one Project is mandatory for each student						
Brief Description of a	elf-learning / F-log	or cach student.				
		a ming component				

The students will be encouraged to learn using Virtual Link. Please add VLink http://vlabs.iitb.ac.in/bootcamp/labs/dbms/exp8/exp/index.php

Semester II	
Computer Organization	& Architecture

1. Name of the Department: CSE							
2. Course Name	Computer	L	Т		Р		
	Organization &						
	Architecture						
3. Course Code		3	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)	()	0	Sem ()	Sem ()	
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)							
Lectures = 36		Tutorials = 0	Practic	al = 0			

Course Description:

Introduction to organizational Basic building block diagram of a digital computer system. As the course progresses each major block ranging from Processor to I/O will be discussed in their full architectural detail. The course talks primarily about Computer Organization and Architecture issues, Architecture of a typical Processor, Memory Organization, I/O devices and their interface and System Bus organization etc.

Learning objectives:

- 1. To understand the basic knowledge of Computer system and its component and functioning of each components.
- **2.** To understand and analyze computer architecture and organization, computer arithmetic, and CPU design.
- 3. To understand I/O system interconnection
- 4. To understand Memory organization.

Course Outcomes:

- 1. Able to understand Computer system and its component and functioning of each components.
- 2. To analyze computer architecture and organization, computer arithmetic, and CPU design.
- 3. To understand I/O system and interconnection structures of computer system.
- 4. To understand and analyze I/O techniques and functioning of memory.
- 5. To understand various types of buses in a computer system and illustrate how data transfers is performed.

11. Unit wise detailed content

Unit-1	Number of					
	lectures = 10					
Information Repr	Information Representation: Number systems, BCD codes, character codes, error detecting and					
correcting codes, f	ixed-point and floati	ing point representation of information. Binary arithmetic				
operations.						
Binary Logic: Log	gic gates, Boolean al	gebra, Boolean functions, truth tables, canonical and				
standard forms, sin	nplification of Book	ean functions.				
Combinational Lo	ogic circuits: Design	n procedure, adders, subtractors, encoders, decoders,				
multiplexers and de	emultiplexers.					
Unit - 2	Number of					
	lectures = 8					
Sequential Logic circuits: Flip-flops: R-S, J-K FF, Master slave J-K FF, D FF, T FF, computer						
registers.						
Counters: Synchro	onous, Asynchronou	us, updown and programmable counters.				

Unit - 3	Number of	Title of the unit: Network Layer					
CDU angenization	lectures = 8	ration Mashing instructions instruction avalage moments					
CPU organization	CPU organization: Processor organization, Machine instructions, instruction cycles, memory						
reference instruct	tions, stack organ	inzation, instruction formats and addressing modes,					
meroprogramming	g concepts, Types of	interrupts.					
I/O Organization	n: I/O interface,	interrupt structure, transfer of information between					
CPU/memory and	I/O devices, DMA a	nd IOP.					
Unit - 4	Number of						
D	lectures = 8						
Basic concepts – Sem	iconductor RAMS -	ROMS – Speed - size and cost – Cache memories -					
etornance considera	dovice Intermeter	Dry- Memory Management requirements – Secondary					
Storage, Accessing I/O	\circ (PCL SCSL USP)	s – Direct Memory Access – Buses – Interface circuits –					
11 Drief Description	$\frac{S(FCI, SCSI, USD)}{F(rcification)}$						
The students will be or	of sell learning / E-le	sing the SCT E Learning portal and choose the relevant					
lectures delivered by su	ubject experts of SG	T University					
The link to the E Learn	ning portal	i University.					
	ning portai.						
https://elearning.sgtuni	iversity ac in/course	-category/					
13 Text Books Recom	mended						
Computer Organization	n and Architecture –	- Designing for Performance - William Stallings.					
Pearson Educat	tion. 9 th Edition. 201	2.					
Digital Logic a	nd Computer Design	n- Mano, M. Morris, Pearson Education First Edition, 2016.					
8							
Reference Books							
Computer Organization	n - Carl Hamacher, Z	Zvonko Vranesic and Safwat Zaky, 5th Edition, McGraw-					
Hill, 2011	,						
Computer Organisation	n and Design - Patte	rson, Elsevier Pub., 4 th Edition, 2011					
Computer Organization	n and Design: The h	ardware / software interface - David A.Patterson					
Computer Architecture	e and Organization -	John P.Hayes, Tata McGraw Hill,3rd Edition,2017					

	ŀ	Advanced Java				
	Name of the Depart	ment- Computer Scien	ce & En	gineering		
2. Course	Advanced Java	L	Т		P	
Name						
3. Course		3	0		0	
Code						
(13470204)						
4. Type of Cour	se (use tick mark)	Core (✓)	PE()		OE ()	
5. Pre-	Basic knowledge of	6. Frequency (use	Even	Odd ()	Either	Ever
requisite (if	C programming	tick marks)	()		Sem ()	у
any)	language.					Sem
						0
7. Total Number	r of Lectures, Tutorial	s, Practical (assuming	12 week	s of one se	emester)	•
Lectures = 36		Tutorials = 0	Prac	tical = 0		
8. Course Descr	iption					
The revolution in	IT (Information Techn	ology) is possible due to	o evoluti	on of prog	ramming	
languages over th	ne time. With the time, t	he programming langua	ges becc	me more s	simple, obj	ect
oriented, robust a	and secure to use. Java i	s one of the programmir	ng langu	age that in	bibes all th	ne
above mentioned	features and also, it is u	used to develop mobile,	desktop	GUI, web	-based, clo	ud
computing applic	ations. This course aim	s to cover the advance c	oncept o	of java prog	gramming	
language which i	ncludes network progra	mming, database progra	mming,	and servle	ts.	
9. Learning obje	ectives:	¥ ¥ ¥				
1. To unders	stand the fundamentals	of object-oriented progra	amming	in java, w	hich includ	es the
definition	of classes, methods and	d use of java libraries.	C	0		
2. To unders	stand the application of	java programming langu	age in a	dvance ap	plications.	
10. Course Outo	comes (COs):		<u> </u>	1 .	1	
1. Understan	ding the structure and n	nodel of the java program	nming la	anguage.		
2. Using java	a programming language	e to develop various app	lications	5.		
3. Develop s	oftware using java prog	ramming language.				
11. Unit wise de	tailed content					
Unit-1	Number of lectures					
	= 10					
Introducing class	es, objects and methods	: defining Class Fundan	nentals.	Obiect & (Object refer	rence.
Object Life time	& Garbage Collection.	Creating and Operating	Objects.	Construct	or & initia	lization
code block. Acce	ess Control. Modifiers, r	nethods Nested . Inner (Class & A	Anonymou	s Classes .	Abstract
Class & Interface	es Defining Methods, A	rgument Passing Mecha	nism . M	Iethod Ove	erloading.	
Recursion, Deali	ng with Static Members	. Finalize() Method. Na	tive Met	hod. Use c	of "this "ref	ference.
Use of Modifiers	with Classes & Method	ds. Design of Accessors	and Mu	ator Meth	ods Clonin	g
Objects, shallow	and deep cloning. Gene	eric Class Types.				0
Extending Classes and Inheritance: Use and Benefits of Inheritance in OOP. Types of Inheritance in						
Java, Inheriting Data members and Methods. Role of Constructors in inheritance. Overriding Super						
Class Methods. U	Jse of "super", Polymor	phism in inheritance. Ty	ype Com	patibility	and Conver	rsion
Implementing interfaces.						
Unit -2	Number of lectures					
	= 9					
Thread: Understa	anding Threads, Needs of	of Multi-Threaded Progr	amming	,Thread L	ife-Cycle,	Thread
Priorities ,Synchronizing Threads, Inter Communication of Threads ,Critical Factor in Thread –						

Deadlock.

Semester II

GUI Programmin	ng:Designing Graphical	User Interfaces in Java, Components and Containers, Basics
of Components, I	Using Containers, Layo	ut Managers, AWT Components, Adding a Menu to
Window, Extend	ing GUI Features Using	Swing Components, Java Utilities (java.util Package) The
Collection Frame	work : Collections of C	Objects, Collection Types, Sets, Sequence, Map,
Understanding H	ashing, Use of ArrayLis	st& Vector.
Unit – 3	Number of lectures	
	= 8	
Event Handling:	Event-Driven Programn	ning in Java, Event- Handling Process, Event-Handling
Mechanism, The	Delegation Model of E	vent Handling, Event Classes, Event Sources, Event
Listeners, Adapte	er Classes as Helper Cla	sses in Event Handling.
Network Program	nming: Socket based co	mmunication & Remote method invocation (RMI).
Unit – 4	Number of lectures	
	= 9	
Database Program	nming using JDBC: Int	roduction to JDBC, JDBC Drivers & Architecture, CURD
operation Using J	JDBC, Connecting to no	on-conventional Databases.
Java Server Tech	nologies (Servlet): Web	Application Basics. Architecture and challenges of Web
Application. Intro	oduction to servlet. Serv	vet life cycle. Developing and Deploying Servlets. Exploring
Deployment, Des	scriptor (web.xml), Han	dling Request and Response.
12. Brief Descrip	tion 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 S	SGT University
The link to the E	-Learning portal	
https://elearning.	sotuniversity ac in/cours	se-category/
<u>inteps://elearning.c</u>	<u>sgram versit y ao ini cours</u>	
13. Books Recon	nmended	
Text Books		
Java, Herbert Sch	nildt. "The Complete Re	ference." Complete Reference Series) 10th Edition New
York: McGraw-H	Hill Education (2017).	
Reference Books	S	
SAMANTA, DE	BASIS. Object-oriented	Programming with C++ and Java. PHI Learning Pvt. Ltd.,
2006	v	

https://cse.iitkgp.ac.in/~dsamanta/java/index.htm, https://nptel.ac.in/courses/106/105/106105191/ E. Balaguruswamy, "Programming with Java: A Primer", McGraw-Hill; Sixth edition, 2019.

Semester II Medical Image Processing

Name of the	e Department- Compu	ter Science & Engineerir	ng			
2. Course	Medical Image	L	Т		Р	
Name	Processing					
	_					
3 Course		3	0		0	
S. Course Code		5	U		U	
4. Type of (Course (use tick	Com ()	ΡΕΟ		OE ()	
mark)	sourse (use tien		1 10		OL ()	
5. Pre-	Basic knowledge of	6. Frequency (use tick	Even	Odd	Either	Everv
requisite	C programming	marks)	(./)	0	Sem ()	Sem ()
(if any)	language.	, ,		~	Ŭ	v
7. Total Nu	mber of Lectures, Tut	orials, Practical (assumir	ng 12 week	s of one	e semeste	r)
Lectures =	36	Tutorials = 0	Practical	= 0		
8. Course D	escription					
The purpose	e of this course is to lear	n the fundamentals and va	rious techn	iques of	f medical	image
processing a	nd to develop the algor	ithms for image analysis a	nd diagnosi	is in me	dical imag	ging.
9. Learning	gobjectives:					
1. stud	y of methods for enhanc	ing, analyzing, interpretin	g			
2. visu	alizing information fron	n two- and three-dimension	nal data obt	ained fr	om a vari	ety of
med	ical imaging modalities.					
10. Course	Outcomes (COs):					
1. Ident	ify major processes invo	olved in formation of medi	ical images			
2. Reco	gnize the imaging moda	ality from their visualization	n			
3. Class	ify the various medical	image processing algorith	ms			
4. Desc	ribe fundamental metho	ds of image enhancement				
11. Unit wis	se detailed content					
Unit-1	Number of lectures					
	= 10					
Fundamenta	lls of Digital image Ima	ge formation, visual perce	ption, CCD	& CM	OS Image	e sensor,
Image samp	ling: Two dimensional	Sampling theory, Nonrecta	angular grio	and He	exagonal	
sampling, O	ptimal sampling, Image	e quantization, Non uniform	n Quantiza	tion, Im	age forma	ats.
Types of pix	kel Operations, Types of	f neighborhoods, adjacenc	y, connecti	vity, bo	undaries,	regions,
2Dconvolut	ion, Color models.					
Unit – 2	Number of lectures					
	= 9					
Image Enha	ncement in Spatial and	Frequency domain				
Basic gray 1	evel transformations, hi	stogram processing, Smoo	thing operation	ations, E	Edge Dete	ection-
derivative b	ased operation, filtering	in frequency domain, 2D-	-DFT, Smo	othing f	requency	domain
filters, Shar	pening frequency domai	in filters, Homomorphic fi	ltering.			
Unit – 3	Number of lectures					
	= 8					
Morphologi	cal Image Processing					
Dilation and	Dilation and Erosion, Opening and Closing, Hit-or-Miss transformation, Boundary Extraction,					

Region filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening,

Skeletons, Pruning.

Image Segmentation

Detection of discontinuities, Point-line- edge detection, Linear and Circular Hough Transform, Basic Global and Adaptive Thresholding, Region Based segmentation, K-Means Clustering

Unit – 4	Number of lectures
	= 9

Image Compression:

Fundamentals of Image compression models, Lossless compression: variable length coding, LZW coding, Arithmetic coding, Lossy compression: Wavelet and DCT coding, Predictive coding. Representation and Description

Image features, Feature extraction, Chain code, Moments

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.

13. Books Recommended

Text Books

1. Digital Image Processing, Gonzalez and Woods- Pearson Education

2. Digital Image Processing, S. Sridhar – Oxford University Press.

Reference Books

- 1. Fundamentals of Digital Image Processing, A.K. Jain .P.H.I.
- 2. Digital Image Processing, William Pratt- John Wiley.
- 3. Feature Extraction and Image Processing, Mark S. Nixon and Alberto S. Aguado.
- 4. Digital Image Processing and Analysis, Chanda Majumder- Printice Hall India.
- 5. 7. Medical image processing, Geoff Dougherty edito

Semester II **Advanced Operating System**

1. Name of the	Department- Com	1. Name of the Department- Computer Science & Engineering						
2. Course	Advanced	L	Т	Р				
Name	Operating							
	System							
	·							
3. Course		3	0	0				
Code								
4. Type of Cou	rse (use tick	Core (✔)	PE()	OE ()				
mark)								
5. Pre-	Operating	6. Frequency (use	Even Odd ()	Either Every				
requisite	System	tick marks)	Lven	Sem() Sem()				
(if any)	-		(✔)					
7. Total Numb	er of Lectures, Tu	orials, Practical (assun	ning 12 weeks of o	one semester)				
Lectures = $3\overline{6}$		Tutorials = 0	Practical = 0					
	• •							
8. Course Desc	cription		• • • •					
Demons	trate knowledge and	understanding of the en	gineering and mar	nagement				
principles and a	pply these to one	s own work, as a membe	er and leader in a t	eam, to manage				
projects and in i	nutraiscipinary en	vironments.						
9. Learning ob	jectives:							
1. To impart t	he knowledge on the	he need and requirement	t of an interface	between Man and				
Machine.	-	-						
2. To teach th	e features of operation	ating systems and the f	undamental theor	y associated with				
process, mer	mory and file manag	gement components of op	perating systems.					
3. To understa	nd the memory Arch	nitecture						
10. Course Out	comes (COs):							
The stud	lents will be able to							
• Describe	the general archite	cture of computers	. , . ,					
• Describe	e, contrast and comp	are differing structures f	or operating system	ns				
• Understa	and and analyse theo	ory and implementation (of: processes, resol	urce control				
(concurr 11 Unit wise d	ency etc.), physical	and virtual memory, sen	eduning, 1/O and 1	lles				
Init.1	Number of							
	lactures - AA							
	iectures = 09							
Introductio	n : Definition, Ope	erating System Structu	re. Operating Sy	stem Operations.				
Distributed	system, Methodolog	gies for implementation	of O/S service, P	rocesses: Process				
model, Proc	ess states, process h	ierarchies, implementati	on of Processes,da	ata structures used				
such as Process table, PCB creation of processes, context switching, exit of Processes.								
Inton mus	a communication	n. Doog oorditions	anition and in	a problems of				
mutualayah	sion Deterson's	II: Kace conditions,	critical section	s, problems of Reader Writer's				
Problem Di	ning Philosophers P	rohlem semanhores mo	onitors message p	Assing				
	mig i mosophers i	robeni, semaphores, me	mors, mossage pa					
Unit – 2	Number of							
	lectures = 09							
Process s	scheduling: object	ctive, preemptive v	vs. non-preempt	ive scheduling,				

comparativeassessment of different algorithms such as round robin, priority bases scheduling. FCFS. SJF, multiple queues with feedback

Deadlocks: Conditions, modeling, detection and recovery, deadlock avoidance, deadlockprevention.

Memory Management: Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual Memory, Demand Paging

Unit – 3	Number of
	lectures = 08

File Management- File-System Interface- File Concept- Access Methods – Directory and Disk Structure – File-System Mounting – File Sharing- Protection- File-System Implementation-FileSystem Structure- File-System Implementation- Directory Implementation- Allocation Methods Free-Space Management – Efficiency and Performance

Unit – 4	Number of	
	lectures = 10	

Mass Storage Structure- Disk Scheduling- Disk ManagementRAID Structure – Stable Storage Implementation- Protection and Security- Protection- Goals of Protection- Principles of ProtectionDomain of Protection- Access Matrix Implementation of Access Matrix- Access Control- Revocation of Access Rights SecurityThe Security Problem – Program Threats- System and Network Threats.

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/course-category/

13. Books Recommended

Text Books

• William Stallings, Operating Systems: Internals and Design Principles, 6 th Ed., Pearson Education

14. Reference Books

Nutt G.J., Operating Systems, 3 rd Ed., Pearson Education.
Silberschatz, Galvin, & Gagne, Operating System Concepts, 8 th Ed., Wiley
Tanenbaum A.S., Modern Operating Systems, 3 rd Ed., Prentice Hall

Semester II								
Data Structures and Algorithm Design								
Name of the Department- Computer Science & Engineering Course Nome Data Structures L								
Course Name	Data Structures	L	I			P		
	Design							
Course Code	Design	3	0			0		
Type of Course (use t	ick mark)	$Core(\checkmark)$	PE	0		OE ()		
Pre-requisite (if	,	Frequency (use	Ev		Odd	Either	Everv	
any)		tick marks)	L	ch (•)	0	Sem ()	Sem ()	
Total Number of Lect	tures, Tutorials, Pr	actical (assuming 1	2 w	eeks of o	ne semes	ter)		
Lectures = 36		Tutorials = 0		Practica	al = 0			
Course Description								
Topics include element	tary data structures,	(including arrays, st	acks	s, queues,	and lists)), advance	ed data	
structures (including tr	ees and graphs), the	algorithms used to i	man	ipulate th	ese struct	tures, and	their	
application to solving p	practical engineering	g problems.						
Students study techniq	ues for designing al	gorithms and for ana	ılyzı	ng the tin	he and sp	ace effici	ency	
of algorithms. The algo	orithm design techni	iques include divide-	-and	-conquer,	greedy a	lgorithms	8,	
dynamic programming	•							
Learning objectives:	& file structure cor	conts and algorithm	C					
1. Learn new data	d where these cores	nte would be used in	S.	l world a	nnlightion	na and		
2. Learn when and	ontexts	pis would be used in	1100	li-woriu aj	ppilcation	lis and		
3 Apply many of	these concepts/algo	rithms by using ther	n in	nrogram	ning proi	ects		
4. Date Structures	are an integral part	of algorithm design	and	Discrete	Structure	es covers f	topics	
like graph theor	rv.	of algorithm design	unu	Districte	Structure		opies	
Course Outcomes (Co	Os):							
1. Understand of the	he basic data structu	ires.						
2. The appropriate	use of a particular of	data structure and alg	gorit	hm to sol	ve a prob	olem.		
3. Demonstrate a f	amiliarity with majo	or algorithms and dat	ta st	ructures.				
4. Apply importan	t algorithmic design	paradigms and met	hods	s of analys	sis.			
5. Synthesize effic	ient algorithms in co	ommon engineering	desi	ign situati	ons.			
Unit wise detailed	content	0 0		0				
Unit-1	Number of							
	lectures = 09							
Introduction to Data St	ructure: Data types,	Abstract Data types	s, Ar	rays, Arra	ays as abs	stract data	a type,	
Arrays row major and	column major, Sequ	ences, Big Oh notat	ions	. Stack: D	Definition	and Exai	nple,	
Representing Stack usi	ng static implement	ation, Applications,	Infi	x, Prefix a	and postf	ix, Conve	erting	
infix to postfix Express	sion, Evaluation Ma	tching parentheses, I	Rec	ursion and	l Simulat	ing Recu	rsion.	
Queues: Definition and	l examples, Represe	enting Queues using	stati	ic implem	entation,	Circular o	lueues,	
Priority queues, Double	e-ended queues.							
Unit – 2	Number of							
	lectures = 09							
Linked Lists: List Type	es (singly, doubly, s	ingly circular, doubl	ly ci	rcular), O	perations	on alltyp	bes of	
Lists – create, insert, d	elete Generalized Li	ists Applications, Dy	ynan	nic implei	nentatior	n of stack	and	
queues, Polynomial Addition, Dynamic Memory Allocation – First- Fit, Best – Fit, Worst-fit								
Trees: Concept Rooted	Tree Binary Tree-	Linked and static Re	pres	sentation,	TreeTrav	versals (Pr	re-	
order, In-order, Post-order using recursion), Binary Search Tree (create, delete, search, insert,								

display), AVL Trees.

Unit – 3	Number of				
	lectures = 08				
Introduction: Algo	rithm, Analyzing algori	thm, Designing algorithm, Concept of algorithmic			
efficiency, Run time analysis of algorithms, Asymptotic Notations.					
Divide and Conquer: Structure of divide and conquer algorithms; examples; Greedy Method:					
Overview of the G	reedy Paradigm, Examp	bles of Exact Optimization solution (minimum cost			
spanning tree) Dynamic Programming: Overview, Difference between Dynamic Programming and					
Divide and Conquer, Applications: Shortest path in graph, Traveling salesman Problem.					
Unit – 4	Number of				
	lectures = 10				

Back Tracking: Overview, 8-queen problem, Graph Coloring Problem and Knapsack problem Graphs: Representation using C Adjacency matrix and adjacency lists BFS and DFS bystatic and dynamic implementation, Finding shortest path (Dijkstra's Algorithm) Searching: Sequential, Binary, Hashing, Hash tables, Hash functions, Overflow handlingtechniques.

Sorting: Bubble sort, Insertion sort, Quick sort (recursive), Merge sort, Heap sort andBucket sort. Complexity measures, Polynomial vs. non-polynomial time complexity; NP-hard and NP-complete classes, examples.

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/course-category/

Books Recommended

Text Books

Data Structures with C (Schaum's Outline Series), Seymour Lipschutz, McGraw Hill Education; 1st edition, 2017.

Introduction of Computer Algorithm, T. H Cormen, Leiserson, Rivest and Stein, PHI, New Delhi. Fundamentals of Computer Algorithms. 2nd Edition, E. Horowitz, S. Sahni, and S.Rajsekran, University Press, Hyderabad.

Reference Books

Computer Algorithms, Sara Basse, A.V. Gilder, Addison Wesley, New Delhi.

Fundamentals of Data Structure, E. Horowitz, S. Sahni, and S.Rajsekran University Press, Hyderabad Data Structures Using C, Balagurusamy, McGraw Hill Education; First edition, 2016

	S	emester II					
1 Name of the Doney	Advanced O	perating System Lab]	
1. Name of the Depart	Advanced	Science & Engineering			D		
2. Course Name	Auvanceu	L	1		r		
	System Lab						
	System Lab						
3. Course Code		0	0 2				
4. Type of Course (us	se tick mark)	Coro(I)	$\begin{array}{c c} 0 & 2 \\ \hline \mathbf{PE} 0 & \mathbf{OE} 0 \\ \end{array}$				
	,					F	
5. Pre-requisite (II		6. Frequency (use	Even	Even Odd ()		Every Som ()	
any)		uck marks)	(\checkmark)		Sem()	Sem ()	
7 Total Number of I	ectures Tutorials	Practical (assuming 1'	weeks (f one ser	nester)		
Lectures $= 0$	Actures, rutoriais,	Tutorials = 0	Practic	$\frac{1}{1} = 24$	nester)		
8. Course Description	n		Tructic	ui – 2 i			
This course will intro	duce the core conce	pts of operating systems	. such as	processes	and thre	ads.	
scheduling, synchroni	ization, memory ma	nagement, file systems,	input and	output d	evice	,	
management	, <u>,</u>		1	1			
and security							
9. Learning objectiv	es:						
1. To learn the me	echanisms of OS to I	handle processes and thr	eads and	their con	municati	on	
2. To learn the me	echanisms involved	in memory management	in conter	mporary (OS		
3. To gain knowle	edge on distributed of	perating system concep	ts that inc	cludes arc	chitecture	,	
Mutual exclusion	on algorithms, dead	lock detection algorithm	s and agr	eement p	rotocols		
10. Course Outcomes	(COs):						
1. The ability to res	search, understand a	nd implement computer	program	s in the a	reas relate	ed to	
algorithms, sys	tem software, multi	media, web design, big d	lata analy	tics, and	networkir	ng for	
efficient analys	is and design of cor	nputer-based systems of	varying o	complexit	у	_	
2. The ability to ap	oply standard practic	es and strategies in soft	ware proj	ect devel	opment u	sing	
open-ended pro	ogramming environr	nents to deliver a quality	product	Ior busin	ess succes	SS	
3. The ability to e innovative care	employ modern com	trepreneur, and a zest for	onments, or higher s	and plath	orms in c	reating	
			0				
11. List of Experimen	lts						
1. Write a C prog	ram to simulate the	FCFS CPU scheduling	algorithn	ns to find	turnarou	nd time	
and waiting time.							
2. Write a C program to simulate the SJF CPU scheduling algorithms to find turnaround time							
and waiting time.							
3. Write a C program to simulate the Round Robin (preemptive) CPU scheduling algorithms to							
1111 turnaround time and waiting time.							
4. write a C program to simulate the Friency CFO scheduling algorithms to find turnaround time							
and waiting time. 5 Write a C program to simulate the MVT and MET memory management techniques							
6 Write a C progr	5. Write a C program to simulate the paging technique of memory management						
7 Write a C progr	7. Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance						
8. Write a C progr	ram to simulate FIF	O nage renlacement aloc	rithms	acuulock	avoidant	\sim	
9 Write a C program to simulate I RU page replacement algorithms							
10 Write a C program to simulate LEU page replacement algorithms							
11. Write a C program to simulate producer-consumer problem using semaphores							
12. Write a C prog	12. Write a C program to simulate the concept of Dining-Philosophers problem.						

During the course student must be do project on:

- 1. The Unix Shell (Student can build project How processes are handled (i.e., starting and waiting for their termination))
- 2. Web Servers and Synchronization (Student can modify an existing code to learn how to create and synchronize cooperating threads in Unix and gain exposure to how a basic web server is structured)
- 3. A "Better" Malloc
- 4. A "File System" (Build a file system using the FUSE library, Keep adding more and more system calls and features as time rolls)

At least one Project is mandatory for each student.

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

The students will be encouraged to learn using Virtual Link. Please add VLink

	Data	Semester II Structures and Algorit	thm I ah					
Name of the Department- Computer Science & Engineering								
Course Name	Data Structures and Algorithm Lab	L	T		P			
Course Code		0	0 2					
Type of Cour mark)	se (use tick	Core (🖌)	PE () OE ()					
Pre- requisite (if	Data Structure	Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()		
any) Total Numbe	r of Lectures Tuto	rials Practical (assumi	ng 12 we	eks of o	ne semest	er)		
$\frac{10tar Numbe}{Lectures = 0}$	T OI Lectures, Tuto	Tutorials = 0	Practic	al = 24	ne semes			
$\frac{\text{Lectures} = 0}{\text{Course Description}}$	rintion The course i	s designed to develop sk	ills to des	ui – 24 vian and 4	analyze ci	mnle		
linear and nor apply the suita knowledge in	n linear data structur able data structure for practical application	es. It strengthen the abili or the given real world pr as of data structures.	ty to the oblem. It	students enables	to identify them to g	y and ain		
Learning obj	ectives:							
1. To im	part the basic concep	ots of data structures and	algorithr	ns				
2. To uno	derstand concepts at	out searching and sortin	g techniq	ues				
3. To uno	derstand basic conce	pts about stacks, queues	, lists, tre	es and gr	aphs			
4. To uno	derstanding about w	riting algorithms and ste	p by step	approach	n in solvir	ng		
proble	ms with the help of	fundamental data structu	ires			-		
Course Outco	omes (COs):							
1. At the	end of this lab session	on, the student will						
2. Be able	e to design and analy	ze the time and space ef	ficiency	of the dat	a structur	·e ·		
3. Be cap	able to identity the a	ppropriate data structure	for give	n problen	n•			
4. Have p	ractical knowledge	on the applications of dat	ta structu	res				
List of Exper	iments	11						
 BASIC of digital 2. DECIS a quad LOOP Matrix Sorting CHAF string convert Impler Impler Convert Impler Convert Impler Convert Impler Convert Impler Convert Impler Convert Impler 	C TECHNIQUES: S its of a given numbe SION MAKING: Fin Iratic equation- select TING TECHNIQUES Multiplication- Tra g algorithms Search RACTERS AND ST concatenation of two rting upper case alph mentation of ADT L mentation of Stack u mentation of Queue ersion of prefix expre-	wapping of the contents r- Reversing a given num nding the largest and the eting an operation based S & ARRAYS: Finding to anspose-Polynomial addi ing algorithms. RING HANDLING: Fin o strings-checking wheth habets to lowercase and w inked list. using arrays. using arrays ession into post-fix form tree and its Traversals a)	of two va nber. smallest on a men the sum to tion- Poly ding the l her it is a vice versa using sta Preorder	ariables- 1 of a give u. o n terms ynomial 1 length of palindron i in a strin cks. b)Inorde	Finding th n array- s of a sine Multiplica string-rev me or not- ng.	ne sum olving series- ation- versal of -		
10. Write b)Quio 11 Design	a C Programming to ck sort 1 develop and exect	implement the followin	g Sorting	techniqu	ies a)Bub	blesort		
accept array 1	ing one element at a representation of hea	time and by inserting it up. Display the array at the	immediation in the end of	tely in to insertion	heap. Use phase.	e the		

- **12.** Design, develop and execute a program in C to implement doubly linked list where each node consist of integers. The program should support following functions.
- **13.** Create a doubly linked list
- 14. Insert a new node
- 15. Delete a node if it is found, otherwise display appropriate message
- 16. Display the nodes of doubly linked list
- **17.** Design, develop and execute a program in C to read a sparse matrix of integer values and make a transpose of it. Use the triple to represent an element in sparse matrix.
- **18.** Design, develop and execute a program in C to implement singly linked list where each node consist of integers. The program should support following functions.
- **19.** Create a singly linked list
- **20.** Insert a new node
- 21. Delete a node if it is found, otherwise display appropriate message
- 22. Display the nodes of singly linked list
- 23. During the course student must be do project on:
- 24. Mini Project in C Personal Diary Management System
- 25. Typing Tutor Project Using C
- **26.** Mini Calendar Using C
- 27. Student Database Management and Enquiry System
- **28.** At least one Project is mandatory for each student.

Semester II Advance Java lab

1. Name of the Department- Computer Science & Engineering							
2. Course Name	Advance Java lab	L	Т		Р		
3. Course Code		0	0		4		
4. Type of Course (use tick mark)		Core (🗸)	PE()		OE ()		
5. Pre-requisite (if	Basic knowledge of	6. Frequency (use	e Even Od Eithe			Every	
any)	C programming	tick marks)	0	d	r	Sem	
	language.			(√)	Sem	0	
7. Total Number of	Lectures, Tutorials, P	ractical (assuming 12	weeks	of one	semeste	r)	
Lectures = 0	, , , , , , , , , , , , , , , , ,	Tutorials = 0	Practi	cal = 4	8	,	
8. Course Description	on						
The revolution in IT	(Information Technolog	gy) is possible due to e	evolution	n of pro	ogrammi	ng	
languages over the ti	me. With the time, the	programming language	es becon	ne simj	pler, obje	ct	
oriented, robust and	secure to use. Java is or	e of the programming	languag	ge that	imbibes a	all the	
above mentioned fea	tures and also, it is used	to develop mobile, de	esktop C	iUI, we	eb-based,	, cloud	
computing application	ons. This course aims to	cover the advance cor	icept of	java pi	rogramm	ıng	
language which inclusion	ides network programm	ling, database program	iming, a	na			
Sel viets.							
Learning objectives	S :						
1. To understan	d the fundamentals of o	bject-oriented progran	nming in	1 java.	which in	cludes	
the definition	of classes, methods and	d use of java libraries.	0	J,			
2. To understan	d the application of java	a programming languag	ge in ad	vance a	applicatio	ons.	
10.Course Outcome	es (COs):						
1. Understanding	g the structure and mode	el of the java program	ning lan	iguage.			
2. Using java pro	ogramming language to	develop various applie	cations.				
3. Develop softw	vare using java program	ming language.					
11. List of Experiment	ents						
1. WAP that describe	es a class person. It show	uld have instance varia	bles to a	record	name, ag	e and	
salary. Create a person object. Set and display its instance variables.							
2. Write a program to show the concept of Constructors.							
3. Write an application	on that shows thread syl	hchronization.					
4. Write an application that displays deadlock between							
5. Write an application that shows thread priorities							
6. WAP to add label and button in a frame.							
7. WAP to add panel to GUI.							
8. WAP to create a swing button.							
9. WAP to create JFrame, JButton and method call inside the							
java constructor.							
10. WAP to execute select query using JDBC.							
11. WAP to update client information in the database.							
12. WAP of database connectivity using JDBC-ODBC							
urivers.							

13. WAP to implement simple servlet that generates the plain text.

14. WAP to display cookie id.

15. WAP to implement socket programming.

16. Write RMI based client-server programs.

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

https://www.geeksforgeeks.org/introduction-java-servlets/ https://www.geeksforgeeks.org/socket-programming-in-java/

Semester III

Programming in Python

Name of the Department- Computer Science & Engineering							
Course Name	Programming	L	T		Р		
	in Python						
Course Code	· · ·	2	0		0		
Type of Course	(use tick mark)	Core (✓)	PE ()		OE ()		
Pre-requisite	Basics of	Frequency (use tick	Even	(\ .) bbO	Either Every		
(if any)	Programming	marks)	0	000 ()	Sem ()	Sem ()	
Total Number o	f Lectures, Tutoria	als, Practical (assuming	12 week	s of one sem	ester)		
Lectures = 36		Tutorials = 0	Practic	al = 0			
Course Descript	tion						
An introduction t	to the Python progra	mming language. Cover	s details	of how to sta	rt and sto	p the	
interpreter and w	rite programs. Intro	duces Python's basic dat	atypes, fi	les, functions	s, and erro	or	
handling.	1 0		• •				
Learning object	ives:						
1. To Learn	concepts of various	Python script at the shell	ll prompt	, Python type	es, expres	sions to	
solve rela	tive problems				-		
2. To learn of	different libraries of	python					
3. To learn a	xml						
Course Outcom	es (COs):						
1. To utilize	high-level data type	es such as lists and diction	naries				
2. To import	and utilize a modul	e read from and write to	a text file	2			
3. Understan	d the difference bet	ween mutable and immu	table type	es			
4. To demon	stration of IDE"s: I	DLE, IPvthon, IPvthon N	Notebook	hosted envi	ronments		
			totesson				
Unit wise detail	ed content						
Unit-1 Number of							
	lectures = 09						
What is Python?,	Advantages and dis	sadvantages' Downloadi	ng and in	stalling, Whi	ch versio	n of	
Python Running	Python Scripts, Usi	ng the interpreter interac	tively.	U,			
			,				
Unit – 2	Number of						
	lectures $= 09$						
Using variables String types: normal raw and Unicode String operators and expressions Math							
operators and expressions. Writing to the screen Reading from the keyboard. Indenting is							
significant The if and elif statements. While Loops, Using List Dictionaries, Using the for							
statement. Opening, reading and writing a text file. Using Pandas, the python data analysis library							
and data frames, Grouping, aggregating and applying, merging and joining. Dealing with syntax							
errors, Exceptions, Handling exceptions with try/excep							
Unit – 3 Number of							
	lectures = 09						
RE Pattern Matching, Parsing Data, Introduction to Regression. Types of Regression. Use Cases.							
Exploratory data analysis, Correlation Matrix, Visualization using Metplotlib, Implementing linear							
regression							
Unit – 4	Number of						
	lectures = 9						
Machine Learning – Algorithm, Algorithms – Random forest, Super vector Machine, Random							

Forest, Build your own model in python, Comparison between random forest and decision tree

Brief Description of self-learning / E-learning component

This learning method gives students to find out their learning capability. Students involve some sort of choice in this learning. As self directed learning learners can determine which modules or scenarios to review again and again.

https://elearning.sgtuniversity.ac.in/course-category/

Books Recommended

Text Books

Learning to Program Using Python by Cody Jackson

Python for complete beginners by Dr. Martin Jones

Reference Books

Fundamentals of Python: First Programs by Ken Lambert

Learning Python, 5th Edition by Mark Lutz, O'Reilly Media.

Easy GUI Programming in Python by Ken Lambert

The Practice of Computing Using Python by Bill Punch and Rich Enbody
Semester III Research Methodology

1. Name of the Depa	artment- Computer	Science & Engineeri	ng			
2. Course Name	Research Methodology	L	Т		Р	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)	Core (\checkmark)	PEO		OE ()	
5. Pre-requisite (if	+ 2 Mathematics	6. Frequency (use	Even	Odd	Either	Everv
any)		tick marks)	0	(✓)	Sem()	Sem ()
7. Total Number of	Lectures, Tutorials,	Practical (assuming	12 weeks	of one se	mester)	
Lectures = 36		Tutorials = 0	Practica	l = 0	· · ·	
8. Course Descripti	on	l	1			
Course prelude the f	oundational methods	and techniques of aca	demic rese	earch in so	cial science	ces and
engineering. Enginee	ers would examine an	d be practically expos	ed to the 1	nain comp	onents of	a research
framework i.e., prob	lem definition, researc	ch design, data collect	tion & con	npilations,	report wr	iting,
presentation and con	clude. Course intende	d for students requiring	ng hands c	on knowled	lge of eng	ineering &
sciences applications	S.					
1 The primary	biective of this cours	e is to develop a roson	urch orient	ation amo	na the ena	ineers
1. The primary c 2 To provide a	foundation for post-se	e is to develop a resea		ation anio	ng me eng	,iiieei s.
3 To facilitate f	he development and a	polication of problem	_colving c	kille inetu	dents	
J. To facilitate t	ne development and a	pplication of problem	-sorving s	KIII5 IIIstuv	Jents.	
10. Course Outcom	es (COs):					
The students will be	e able to:-					
1. To develop un	nderstanding of the ba	sic framework of rese	earch proc	ess.		
2. To develop an	n understanding of var	rious research designs	and techn	iques.		
3. To identify va	arious sources of infor	mation for literature r	eview and	l data colle	ection.	
4. To develop an	n understanding of the	e ethical dimensions of	f conducti	ng applied	l research.	
5. To develop an	n understanding of qua	ality research & schol	arly writin	ıg.		
11. Unit wise detail	ed content					
Unit-1	Number of	Sources and Prese	ntation o	of Data		
	lectures = 9					
Sources and Preser	ntation of Data					
Statistical D	ata, Methods of Pres	sentation, Presentation	on or Illu	stration o	f Quantit	ative Data and
Qualitative Data.						
Measures of Locati	ion – Averages and	Percentiles				
Measure of c	central tendency – A	verages, Measure o	f Locatio	n – Perce	ntiles.	
Unit – 2	Number of lectures = 9	Variability and its	Measure	es		
Variability and its	Measures					
Types of Va	riability, Measures o	of Variability.Norma	al Distrib	ution and	Normal	Curve,
Demonstration of a	Normal Distribution	n, Normal curve, Re	lative or S	Standard I	Normal D	Deviate or
Variate (Z).						

Unit – 3	Number of lectures = 9	Correlation and Regression
Correlation	and Regression	
Meas	sures of Relationship	p between continuous Variables, Types of Correlation, Correlation
coefficient f	rom Grouped and U	Ingrouped series. Regression and Calculation of Regression
Coefficient.		
1		
Unit – 4	Number of	Research Methodology
	lectures = 9	
Research M Types of res the research conclusion.	lethodology: Meani earch, research appr problems: Selecting Research Design: M	ing of Research, Objective of research, Motivation in research, roaches, research process, & Criteria of good research. Defining g the problems, technique involved in defining the problem and leaning & Need of research design, different research designs.
12. Brief De The students	escription of self-lear s will be encouraged t	rning / E-learning component to learn using the SGT E-Learning portal and choose the relevant lectures

13. Books Recommended

Text Books

C.R. Kothari, Research Methodology, New Age Publications

14. Reference Books

SC Gupta & V K Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons Publications H.C.Saxena, Elementary Statistics, S.Chand Publications. Computers Today, D. H. Sanders, Fourth Edition, McGraw Hill, 1988

Semester III Mobile App Development

	the Department-	computer science & E	ngineeri	ng		
Course	Mobile App	L]	Γ		Р
Name	Development					
Course		3		0		0
Code	~					
Type of (Course (use tick	Core (✓)	Pl	E()		OE ()
	mark)			011/	T1 (1)	
Pre-	OOPS	Frequency (use tick	Even	Odd (Either	Every Sem ()
requisit		marks)	0	√)	Sem	
e (11					0	
any) Totol Nu	mbor of Loctures	Tutorials Prostical (a	couming	12 wook	c of one c	(amostar)
Locturos	$\frac{11001}{-36}$	Tutorials, Γ factical (a	Draatio	$\frac{12}{1} = 0$	s of one s	semester)
Course D	- JU osciption	1 utoriais – 0	Tactic	ai – V		
					1 1.	.1
I his cours	se provides a basic	understanding of Andro	old devel	opment, 1	including	the use of
content pr	oviders, creating a	udio and video services.	. This cou	urse focus	ses on hel	ping people
become ai	n Android applicat	ion developer and releas	sing high	-quality a	pps to the	e marketplace.
Learn abo	ut the various stag	es of development on th	e Androi	d platfori	m and stu	dy topics related
to UI, app	lication services, p	ermissions and security	, graphic	s and vid	eo resour	ces, data
persistenc	e, monitoring tools	s, mobile app marketing	, applicat	tion hosti	ng and m	ore. Develop
core Java	development skills	while you explore key	concepts	for build	ing rich a	pplications using
advanced	features. Learn fro	m instructors and guest	speakers	working	in the inc	lustry.
Learning	objectives:					
1. lea	arn the set up and	installation of Androi	d.			
2. lea	arn Android App	development				
3. lea	arn user interface	s and Controls.				
Course O	utcomes (COs):					
1. Un	derstand the basics	of Android devices and	l Platforn	n.		
2. Ac	auire knowledge o	n basic building blocks	of Andro	id progra	mming re	auired for App
	valanmant	0		1 0	0	1 11
de	velopment					
de 3. Un	derstand persistence	e Data storage mechani	sm in An	ndroid		
de 3. Un 4. Un	derstand persistenced	e Data storage mechani application concepts lik	sm in An te networ	ndroid rking, An	imations	and Google
de 3. Un 4. Un Ma	derstand persistence derstand advanced aps services etc	e Data storage mechani application concepts lik	sm in An te networ	ndroid rking, An	imations	and Google
de 3. Un 4. Un Ma 5. De	derstand persistence derstand advanced aps services etc velop and publish	e Data storage mechani application concepts lik Android applications in	sm in An te networ	ndroid rking, An oid Marke	imations :	and Google
de 3. Un 4. Un Ma 5. De Unit wise	derstand persistence derstand advanced aps services etc velop and publish a detailed content	e Data storage mechani application concepts lik Android applications in	sm in An ce networ to Andro	ndroid king, An id Marke	imations : t	and Google

1 lectures = 09

Introduction: Introduction to mobile application development, trends, introduction to various platforms, introduction to smart phones

Android platform: Android platform features and architecture, versions, comparison added features in each version. ART (Android Runtime), ADB (Android Debug Bridge).

Development environment/IDE: Android studio and its working environment, gradle build system, emulator setup

Application anatomy: Application framework basics: resources layout, values, asset XML representation and generated R.Javafile

Unit Number of

-2 lectures = 09

GUI for Android: Introduction to activities, activities life-cycle, Android v7 support library form API21 for lower version support

Intent: intent object, intent filters, adding categories, linking activities, user interface design

components Views and View Groups: Basic views, picker views, adapter views, Menu, App Bar etc, basics of screen design; different layouts. App widgets. Lollipop Material design: new themes, new widgets, Card layouts. Recycler View Fragments: Introduction to activities, activities life-cycle. Unit Number of -3 lectures = 09Different Data persistence schemes: Shared preferences, File Handling, managing data using SOLite database. Content providers: user content provider, Android in build content providers. Services: introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service. Multithreading: Handlers, AsyncTask Android network programming: HttpUrlConnection, Connecting to REST-based and SOAP based Web services. Broad cast receivers:LocalBroadcastManager, Dynamic broadcast receiver, System Broadcast. PendingIntent, Notifications. Telephony Manager: Sending SMS and making calls. Unit Number of -4 lectures = 9 Location based services: Google maps V2 services using Google API, Animations and Graphics: Property Animation, View Animations, Drawable Animations Media and Camera API: Working with video and audio inputs, camera API Sensor programming: Motion sensors, Position sensors, Environmental sensors. Publishing Android Apps: Guide lines, policies and process of uploading Apps to Google play 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/course-category/ **Books Recommended Text Books** Dawn Griffiths, David Griffiths, "Head First: Android Development", OReilly2015, ISBN: 9781449362188 David Tainar - Mobile Computing: Concepts Methodologies, Tools & Applications. **Reference Books**

Barbara L Ciaramtaro - Mobile technology consumption

Paul Deital, HarveyDeital, Alexander Wald, "Android 6 for Programmers , App Driven approach", 2015, Prentice Hall ,ISBN: 9780134289366

http://developer.android.com/training/index.htmlas on Date 21.4.2016

Semester III Programming in Python Lab

Name of the	Department- Com	puter Science & Engin	eering			
Course	Programming	L	Т		Р	
Name	in Python Lab					
Course		0	0		4	
Code						
Type of Cou	rse (use tick	Core (✓)	PE()		OE ()	
mark)	ſ			1		
Pre-		Frequency (use tick	Even	Odd (Either	Every Sem ()
requisite		marks)	0	√)	Sem ()	
(if any)			10			
I otal Numb	er of Lectures, 1 ut	orials, Practical (assum	ning 12 w	$\frac{1}{2} = \frac{1}{2}$	ne semes	ster)
$\frac{\text{Lectures} = 0}{\text{Course Dece}}$	wintion	1 utorials = 0	Practic	a1 = 40		
Course Desc	ription instings					
Learning ob	jecuves:	and Duthan carint at the	hall prop	ont		
1. 10 lea	arn concepts of varie	Sus Python script at the s	shell profi	npi.	to colve	nalativa nuchlama
2. To gr	orn the use of Dictio	nary& related functions	es and ex	pressions	to solve	relative problems
Course Outo	comes (COs).					
1 To uti	lize high-level data i	types such as lists and di	ictionaries	2		
2 To im	port and utilize a mo	odule • read from and wi	rite to a te	, xt file		
3 unders	tand the difference	between mutable and im	mutable t	vnes		
4 To det	monstration of IDE"	s. IDLE IPython IPyth	on Noteh	ook host	ed enviro	nments
5 To uti	lize high-level data	types such as lists and di	ictionaries	s sources		innentis.
List of Expe	riments	types such as lists and a		,		
1. Demo	onstrate the working	of 'id' and 'type' functi	ons			
2. To fir	nd all prime number	s within a given range.				
3. To pr	int 'n terms of Fibor	acci series using iteration	on.			
4. To de	monstrate use of sli	cing in string				
5. To ad	d 'ing' at the end of	a given string (length sh	ould be a	t least 3).		
6. To co	mpute the frequency	y of the words from the	input. The	e output s	hould out	tput after sorting
the ke	ey alphanumerically		-	_		
7. Write	a program that acce	epts a sequence of white	space sep	arated wo	ords as inj	put and prints the
words	s after removing all	duplicate words and sort	ting them	alphanur	nerically.	
8. To de	monstrate use of lis	t & related functions				
9. To de	monstrate use of Di	ctionary& related functi	ons			
10. To de	monstrate use of tup	ple, set& related function	ns			
11. To im	plement stack using	g list				
12. To im	plement queue usin	g list				
13. To real	ad and write from a	file				
14. To co	py a file					
15. To de	monstrate working	of classes and objects				
16. 10 de	monstrate class met	nod & static method				
17. To de	monstrate construct					
10. 10 de	monstrate approact	ut on/composition				
19. 10 de	monstrate aggregati	on/composition				
20. Durin	g the course student	must be do project on				
21. To cro	eate a small GUI an	plication for insert. upda	ate and de	lete in a t	able using	g Oracle as

21. To create a small GUI application for insert, update and delete in a table using Oracle as

backend and front end for creating form

- **22.** Dice Rolling Simulator (This beginner-level project will help build a strong foundation for fundamental programming concepts)
- **23.** Number Guessing (To compute the difference between the two, and to check whether an actual number was inputted or not)
- 24. Random Password Generator (Student can build a program that intakes some words from the user and then generates a random password using those words.
- 25. At least one Project is mandatory for each student.

Semester III Android App Development Lab

Name of the	Department- Com	puter Science & Engin	eering			
Course	Mobile App	L	Т		Р	
Name	Development					
	Lab					
Course		0	0		4	
Code						
Type of Cou	rse (use tick	Core (✓)	PE()		OE ()	
mark)	ſ					
Pre-		Frequency (use tick	Even	Odd (Either	Every Sem ()
requisite		marks)	0	√)	Sem ()	
(if any)				1 0		
Total Numb	er of Lectures, Tut	orials, Practical (assum	ing 12 w	eeks of o	ne semes	ster)
Lectures $= 0$) 	Tutorials = 0	Practica	al = 24		
Course Desc	ription: Covers inti	oductory mobile applica	tion deve	lopment	for the A	ndroid Operating
System using	g XML and Java. Inc	ludes developing simple	applicati	ons that	could run	
on Android p	nones and tablets.					
Learning ob	jectives:	1				
I. Devel	lop basic Android ap	oplication				
2. Creat	ting Activities	• ,•				
3. Using	g Intents for activity	communication				
4. Devel	lop the GUI applicat	10n.	$(\mathbf{\Omega}\mathbf{\Omega})$			
1 I. I. J		Course Outcomes	(COs):			
1. Under	stand android applic	ation hierarchy, UI com	ponents a	na their r	burpose	1 4
2. Create betwe	e activity, do activity en/among intents.	to activity communicati	on using	intents ai	nd transfe	er data
3. Apply	style to android UI	components				
4. Able t	o use and implemen	t menus, notifications &	impleme	nt notific	ation usir	ng Notification.
5. Config	gure and implement	context menu and optior	n menu as	a part of	android	app.
		List of Experim	ents	1		11
11. List of Ex	speriments					
1. Create a ba	asic mobile applicati	on				
2. Working w	with forms					
3. Android A	pp- working with in	tents				
4. Apply style	e and theme in an ar	ndroid app				
5. Create an A	Android app that do	es payment process via a	context i	nenu		
6. Create an A	Android app that do	es a currency converter o	perations	using an	options	menu
7. Create an A	Android notification	app that displays notific	ation abo	ut the me	essages re	ceived
8. Create an A	Android app for send	ding data from first activ	ity to sec	ond activ	ity.	
9. Create an A	Android app for gett	ing result from second a	ctivity (U	sing start	ActivityF	ForResult)
10. Create an	Android app for sto	oring user data using SQI	LITE	-	2	

Name of the	Department- Com	puter Science & Engin	eering			
Course	Embedded					
Name	systems in	L	Т		Р	
	Medicine					
Course		2	0		0	
Code		3	0		0	
Type of Cou	rse (use tick	Coro (1)	DEA		ΟΕΟ	
mark)			PE()		OE ()	
Pre-	None	Frequency (use tick	Even	Odd	Either	Every Sem ()
requisite		marks)	()	0	Sem ()	
(if any)						
Total Numb	er of Lectures, Tut	orials, Practical (assun	ning 12 w	eeks of o	one semes	ster)
Lectures = 3	6	Tutorials = 0	Practic	al = 0		
Course Desc	ription					
This course e	emphasizes on comp	rehensive treatment of e	mbedded	hardware	e and real	time operating
systems along	g with case studies,	in tune with the requirer	nents of I	ndustry. '	The objec	tive of this
course is to e	nable the students to	o understand embedded-	system pr	ogrammi	ng and ap	oply that
knowledge to	design and develop	embedded solutions.				
Learning ob	jectives:					
1. Basic conc	epts of Embedded S	Systems				
2. Various te	chniques used for de	esigning an embedded sy	vstem.			
3. Real time s	system with an exan	nples				
Course Outo	comes (COs): At th	e end of this course, stu	idents wi	ll be able	e to	
1. Discuss the	e basics of embedde	d systems and its hardwa	are units			
2. Identify the	e various tools and o	levelopment process of e	embedded	l system		
3. Demonstra	te the various I/O ir	terfacing with microcon	troller			
4. Create the	programming for er	nbedded system design				
5. Summarize	e the real time mode	ls, languages and operat	ing syster	ms		
6. Design a r	eal time embedded s	system for biomedical ap	plication	S		
Unit wise de	etailed content	Γ				
Unit-1	Number of					
	lectures = 10					
Definition an	d Classification : O	verview of Processors an	nd hardwa	are units i	in an emb	edded system –
Software em	bedded into the syst	em – Exemplary Embed	ded Syste	ems – Em	bedded S	ystems on a Chip
(SoC) and the	e use of VLSI desig	ned circuits - Embedded	Hardwar	e Archite	cture, Co	mmunication
Interface Star	ndards, Embedded S	System Development Pro	ocess, Em	bedded C	Deprating	systems, Types
of Embedded	Operating systems					
Linit 2	Number of					
Unit - 2	Number of					
Intal MC051	1ectures = 08	stirrage Crasial Frances'	Desist			nonta and
airouita Instr	Architecture: Deriv	ng Modes Assemble L	n register	15 (SFK),	1/U pins,	ports and Counter
Drogrammin	a Sorial Communication	ing induces, Assembly La	nguage P	rogramm	ung, 1 mi	and Counter
Momory	s, serial Communication	ation, Connection to KS	232, Ille	Frupis Pro	9051	b ADC sonsorr
stepper moto	r keyboard & DA		iei. miefl	acing 01		I ADC, SUISOIS,
DIC Microso	ntroller · Introduction	o. On CPU architecture rec	rictors in	etruction	cote adde	assing modes
L oon timing	timers Interrupts	interrupt timing I/o Even	sisters, Iff	$\frac{1}{2} \sum_{i=1}^{2} \sum_{j=1}^{2} \sum_{i=1}^{2} \sum_{i=1}^{2} \sum_{i=1}^{2} \sum_{j=1}^$	sets adur	cosing modes
Analog to die	vital converter IIAE	2T_Baud Rate_Data Han	dling_Ini+	20 Dus O	Special	Features - serial
Programming	z-Parallel Clave Dom	- Daug Kait-Dala Hall	anng-mit	iansation	, special	1 Catures - Schal
	Number of	· ·				
Omt = J						

Semester IV Embedded systems in Medicine

	lectures = 10	
Embedded sy	stem evolution tren	ds: Round - Robin, robin with Interrupts, function-One-Scheduling
Architecture,	Algorithms. Introdu	uction to-assembler-compiler-cross compilers and Intergrated
Development	t Environment (IDE)). Object Oriented Interfacing, Recursion, Debugging strategies,
Simulators. 7	Task and Task States	, tasks and data, semaphores and shared Data Operating system
Services-Mes	ssage queues-Timer	Function- Events-Memory Management, Interrupt Routines in an
RTOS enviro	onment, basic design	Using RTOS.
Unit – 4	Number of	
	lectures = 08	
Applications	: Real-Time Embedd	led Software Development, Sending a Message over a Serial Link,
Simulation of	f a Process Control S	System, Controlling an Appliance from the RT Linux System,
Embedded D	atabase Application	s, Embedded medical applications: Ophthalmology - Glaucoma
screening dev	vice, Medical Imagin	ng Acquisition User Interface, Drug delivery systems, Patient
monitoring S	ystems.	
Brief Descrip	tion of self-learning	y / E-learning component
The students	will be encouraged	to learn using the SGT E-Learning portal and choose the relevant
lectures deliv	vered by subject expo	erts of SGT University.
The link to the	e E-Learning portal	
Books Recor	nmended	
Text Books		
1)Rushmer, "	' Medical Engineerii	ng", Academic Press
2)Yukihito N	lose, " The Artificial	Kidney", C V Moshy Co
3)Kennedy &	z Blackie, " Electron	nedcial Engineering"
4)Webstar, "	Electronic Devices	for Rehabilitation"
Reference B	ooks	
1) Myers, "E	ngineering in Heart	and Blood Vessels", Wiley I nternational
2) David Coo	oney, " Advanced in	Bio medical Engineering", Marcel Decker Publications
3) David Coo	oney, "Biomedical E	Engineering Principles", Marcel Decker Publications
4) Ibrall & G	uytion, "Regulation	s and Control in Physiological Systems ", I nstruments Society USA
5) Brown &	Gann, " Engineering	in Physiology Vol 1 & Vol 2 "

		List of Depar	rtment Electives		
Specialization	Cyber Security & Forensics	AIML	ІоТ	Blockchain	Data Analytics
DE-I	Cyber Forensics and investigation	Neural Network and Deep learning(Vision and NLP)	Design of Smart Systems	Blockchain and Distributed Ledger Technology	Programming for Data Science
DE-II	Mobile Application Security & Penetration Testing	Data Science tools and techniques	Architecting Smart IoT Devices	Design and Development of Blockchain Applications	Big Data Technologies
DE-III	Cloud Security Essentials	Data Visualization	Application of IoT in Robotics	Programming Fundamentals : Golang and Solidity	Mining Massive Data

Cyber Security & Forensics

	Cyber Forensics a	and Investigation				
1. Name of the Depar	tment:- Computer	Science Engineering				
2. Course Name	Cyber Forensics	L	Т		Р	
	and					
	investigation					
3. Course Code		3	0		2	
4. Type of Course (us	e tick mark)	Core (🖌)	PE(✓)		OE ()	
5. Pre-requisite (if	С	6. Frequency (use	Even	Odd	Either	Every
any)		tick marks)	0	(•)	Sem()	Sem()
7. Total Number of L	ectures, Tutorials,	Practical (assuming 12	weeks of	f one sen	nester)	L
Lectures = 36		Tutorials = 0	Practic	al = 24		
8. Course Description	l					
This course enables the	e students to gain in	-depth knowledge in the	field of C	Computer	forensics	s &
Cyber Crime						
9. Learning Object	ives:					
I. To impart the	basic concepts of C	yber Forensics.				
II. To understand	different types of c	yber attacks.				
III. To understand	l analysis of data to	identify evidence, Techn	ical Aspe	ects & Le	gal Aspec	ets
related to cybe	er crime.					
10 Course Outcomes	(\mathbf{COs}) .					
I Understand th	e fundamentals of C	Computer Forensics				
II Learn the issu	es of Data $\Delta_{coursitie}$	on and Data Recovery				
III Explore netwo	orking in cyber fore	sics				
IV To learn analy	vze and validate For	ensics Data				
V. To study the t	ools and tactics asso	ciated with Cyber Foren	sics			
11 Unit wise detailed	content					
II. Unit wise detailed	Number of					
Unit-1	$\frac{1}{10000000000000000000000000000000000$					
Introduction to Cubon	$f_{\text{equation}} = 08$	tion Conveiter Investigat	iona Ca	ma a mata (Tuban Day	
Introduction to Cyber	forensics: Informa	investigating large geal	1011S, CO	rporate C	yber Foi	ensics,
Maliaious software	Turnel of Compute	r Eorongias Tashnolog	e Dala	of Mil	itory Co	aryznig
Forensia Technology	Types of Compute	forcement: Computer	y, Types Eoropoic	5 01 Mill	nary Co Nogy Tu	mputer
Business Computer Ec	rensic Technology	Specialized Forensics T	Torensic Sechnique	, Hidda	n Data an	d How
to Find It Snyware a	nd Adware Encry	specialized Potensies 1 ption Methods and Vulu	nerabiliti	s, muuc	cting Data	a from
Being Compromised	Internet Tracing N	Jethods Security and	Wireless	Technol	ogies Av	voiding
Pitfalls with Firewalls	Riometric Security	Systems	W II CIC35	1 cennor	05103, 11	volumg
Unit -2	Number of					
	locturos -					
	10					
Turnes of Computer I	IU Forancias Systems:	Internet Security Syste	ma Intr	usion D	tostion (watama
Firewall Security Sec	toma Storage Area	Notwork Socurity Syste	tome M	usion De	Disastar D	oystems,
Systems Dublis V L	ens, Storage Alea	Windlage Metersent C-	outilis, INC	stoma S	tallita E	
Systems, Public Key In	mastructure System	is, where is network Se	curity Sys	steins, Sa	aenite En	cryption
Security Systems, In	stant Messaging (IM) Security Systems	, Net P	rivacy S	systems,	Identity
Management Security	Systems, Identity T	hett, Biometric Security	Systems.			

Unit – 3	Number of	
	lectures = 08	

Windows Forensic Analysis: Window artifacts, Evidence volatility, System time, Logged on user(s), Open files, MRUs, Network information, Process information, Service information, Windows Registry, Start up tasks, Memory dumping; Document Forensics: PDF structure, PDF analysis, MS Office Document structure and analysis, Macros, Windows thumbnails, Android Thumbnails.

Unit – 4	Number of
	lectures =
	10

Forensic Tools and Processing of Electronic Evidence: Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.

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.

13. Books Recommended

Text books:

I. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005

Reference books:

- II. Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners, 2 nd Edition, Springer's, 2010
- III. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, 2009
- IV. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010
- V. Guide to Computer Forensics And Investigations Nelson, Bill ; Phillips, Amelia; Enfinger, Frank; Steuat, Christopher Thomson Course Technology.
- VI. Computer Forensics Computer Crime Scene Investigation.Vacca, John R. Charles RiverMedia

Cyber Forensics and inve

1. Name	1. Name of the Department- Computer Science & Engineering							
2.	Cyber Forensics	L	Т		P			
Course	and							
Name	investigation							
	Lab							
3.		3	0		2			
Course								
Code								
4. Type	of Course (use tick	Core (✓)	PE(✓)		OE ()			
mark)			.		D '4	_		
5. Pre-	Computer Basics	6. Frequency (use	Even		Either Som()	Every Som ()		
requisi		UCK marks)	0	(•)	Sem()	Sem ()		
ie (ii anv								
)								
7. Total	Number of Lectures	, Tutorials, Practical (assuming 12	weeks o	f one sen	nester)			
Lecture	$\mathbf{s} = 0$	Tutorials = 0	Practic	al = 10				
8. Cour	se Description							
This cour	rse will cover the fundar	nentals of computer forensics and inves	tigations.	Topics wi	ll include l	nistorical		
and curre	ent computer forensic an	d investigative security issues						
9. Lear	ning Objectives:							
1. Expla	in how to conduct a digi	tal forensics investigation.						
2. Repor	t findings from digital fo	prensic investigations.						
3. Perfor	m recovery of digital ev	idence from various digital devices usin	g a variet	y of softwa	are utilities	5.		
10 Cou	rea Autoomaa (CAa)							
The stuc	lents will be able to:							
1 Utilize	a systematic approach t	o computer investigations						
2. Utilize	e various forensic tools to	o collect digital evidence						
3. Perfor	m digital forensics analy	vsis upon Windows, MAC and LINUX of	perating s	systems				
4. Perfor	m email investigations.		r8 -	J~~~~~~				
11. Lab	Experiments							
Sr.No	Topics							
						CO		
						Cover		
1	Study of Computer H	Forensics and different tools used for for	ensic inve	stigation				
2	How to Recover Del	eted Files using Forensics Tools						
3	Study the steps for h	iding and extract any text file behind an	image file	e/ Audio f	ile			
	using Command Pro	mpt.	-			2		
4	How to Extract Exch	angeable image file format (EXIF) Data	a from Ima	age Files u	ising	1.2		
	Exifreader Software				1,3			
5	How to make the for	ensic image of the hard drive using EnC	ase Foren	SICS.				
6	How to Restoring the	e Evidence Image using EnCase Forensi	CS					
7	How to Collect Emai	il Evidence in Victim PC						
8	How to Extracting E	Browser Artifacts						
9	How to View Last A	ctivity of Your PC						
10	Find Last Connected	USB on your system (USB Forensics)						
11	Comparison of two F	iles for forensics investigation by Comp	are IT sof	tware				
12	Live Forensics Case I	Live Forensics Case Investigation using Autopsy						

Mobile Application Security & Penetration Testing

1. Name of the Department- Computer Science & Engineering							
2. Course Name	Mobile	L	Т		Р		
	Application						
	Security &						
	Penetration						
	Testing						
3. Course Code		3	0		2		
4. Type of Course (use tick mark)		Core (<i>\)</i>	PE (✓)		OE ()		
5. Pre-requisite (if	Basic Java/IOS	6. Frequency (use	Even	Odd	Either	Every	
any)	programming	tick marks)	0	(✔)	Sem()	Sem()	
	skills.						
7. Total Number of L	ectures, Tutorials,	Practical (assuming 12	weeks o	of one ser	nester)		
Lectures = 36		Tutorials = 0	Practic	cal = 0			
8. Course Description	1						
Course benefits the care	er of Penetration Test	ers and IT security person	nel in cha	rge of defe	ending thei	r	
organization's application	ons and data.						

10. LearningObjectives:

- 1. To understand the different types of vulnerabilities that affect mobile applications and have the practical knowledge to attack and exploit them.
- 2. To perform real world attacks on Android Devices and Apps.
- 3. To learn How to Fuzz mobile apps.
- 4. To learn Mobile applications reverse engineering.

10. Course Outcomes (COs):

The students will be able to:-

- 1. Perform real world attacks on Android Devices and Apps.
- 2. Learn Mobile applications reverse engineering.
- 3. Perform Penetration tests of mobile applications.

11. Unit	wise	detailed	content

Unit-1 Number of lectures = 9

ANDROID PENTESTING:Android Architecture, Setting up a Test Environment, Android Build Process, Reversing APKs, Device Rooting, Android Application Fundamentals, Network Traffic, Device and Data Security, Tapjacking, Static Code Analysis, Dynamic Code Analysis

Unit – 2	Number of	
	lectures = 9	

iOS PENTESTING: iOS Architecture, Device Jailbreaking, Setting up a Testing Environment, iOS Building Process, Reversing iOS Apps, iOS Application Fundamentals, iOS Testing Fundamentals, Network Traffic, Device Administrator, Dynamic Analysis

Unit – 3	Number of	
	lectures = 9	

. **Reversing APKs**: APKTool , Dex2Jar , JD-GUI , Smali/Backsmali , Obfuscation , Additional APK Contents , Hardware Optimization , OEM Apps

. **Device Rooting**: What is Rooting , SuperUser and SuperSU, . Potential Issues , Custom ROMs , OmniROM and CyanogenMod,Google Nexus, Implication of Rooting , Rooting for Testing

Unit – 4	Number of	
	lectures = 9	

Device and Data Security: Data Storage, Internal Storage, External Storage. Device Administration API ,MDM Solutions, Root Detection, Third-Party Code, SDK, Libraries, Device Tracking **Static Code Analysis**: Static Code Analysis, Vulnerable Code Snippet, Vulnerability Exploitation, SQL Injection, Selection query, Direct Using User Input, Partial Parametrization, Full Parametrization, ContentProviders, ContentResolver, Path/Directory Traversal, Vulnerable Activities, android permission, intentMessage, Vulnerable Receivers, Vulnerable Services, Shared Preferences, Local Databases, Sqlite3, Tools: Drozer, QARK

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/course-category/

13. Books Recommended

Text Books

Mobile Application Penetration Testing, **Vijay Kumar Velu**, 2016.

14. Reference Books

"The Pentester Blueprint" by Phillip J. Wylie and Kim Crawley, Wiley 2021.

"Penetration Testing For Dummies" by Robert Shimonski, 2020

"AWS Penetration Testing" by Jonathan Helmus, 2019.

1. Name	e of the Department-	Computer Science & Engineering				
2.	Mobile	L	Т		Р	
Course	Application					
Name	Security &					
	Penetration					
	TestingLab					
3.		3	0		2	
Course						
Code	de					
4. Type	Type of Course (use tick Core (\checkmark) PE (\checkmark) OE ()					
mark)	× ×				, v	
5. Pre-	Computer Basics	6. Frequency (use	Even	Odd	Either	Every
requisi		tick marks)	0	(•	Sem()	Sem()
te (if						
any						
)						
7. Total	Number of Lectures	, Tutorials, Practical (assuming 12	2 weeks o	f one sen	nester)	
Lecture	s = 0	Tutorials = 0	Practic	al = 10		
8. Cour	se Description					
This cour	rse will walk you throug	h the process of identifying security iss	ues on An	droid and	iOS applic	ations,
using a w	vide variety of technique	s including Reverse Engineering, Stati-	c/Dynamic	Runtime	and Netwo	ork
Analysis						
11. Lea	rningObjectives:					
1. Teac	hes students mobile app	lication programming.				
2. Teac	hes you how to jailbreak	or root iOS/Android devices.				
3. Teac	hes give you a certificat	ion without any effort.				
4. You	can memorize to pass a	multiple-choice test.				
10. Cou	rse Outcomes (COs):					
The stuc	lents will be able to:-					
1. Te	o acquaint students with	the practical aspects of Design.				
2. To	o understand the importa	ince of User engagement and Experience	e.			
3. To	o learn various developn	nent techniques				
11. Lab	Experiments					
Sr.No	Topics					
						CO
1	To implement Devic	e Rooting.				
2	To implement Tapja	cking.				
3	To implement Andro	id Virtual Machine, Dalvik Executable	(DEX), O	ptimized I	DEX	
	(ODEX), Android NDK.					2
4	To learn Using Emulators, AVD Manager, Create Virtual Device, System Images.					
	Start the emulator.					1,3
5	To implement Reversing APKs 4.1., APKTool 4.2., Dex2Jar.					
6	To implement Su, S	SuperUser and SuperSU rooting.				
7	7 To implement Proxy Configuration. Burp Suite, CA Certificates.					
8	To learn Device Ad	ministration API, MDM Solutions,. Ro	ot Detectio	n.		
9	To implement SQL I	njection. Selection query, Direct Using	User Inpu	t.		
10	To implement Vulne	rable Activities.	1			
	To imperient vanietable retrittes.					

Cloud Security Essentials

≜	iment- Computer a	Science & Engineering							
2. Course Name	Cloud Security	L	Т	Р					
	Essentials								
3. Course Code		3	0	2					
4. Type of Course (us	e tick mark)	Core 🗸	PE (✓)	OE ()					
5. Pre-requisite (if	,	6. Frequency (use	Even Odd	Either Every					
anv)		tick marks)	(\checkmark) ()	Sem() Sem()					
7. Total Number of L	ectures. Tutorials.	Practical (assuming 12	weeks of one sen	nester)					
Lectures = 36	, ,	Tutorials = 0	Practical = 0	,					
8. Course Description	1								
In cloud computing, we	can manipulate, cont	figure and access the hard	lware and softwar	e remotely. In					
general, cloud computing is accessing and storing the files and databases over the internet instead of									
accessing it on your computer's hard drive. Cloud computing offers platform independence, the software is									
not required to be instal	led on any PC. There	e is portability in cloud co	omputing.						
12 LearningOhiective	·C•								
1 Understand the co	omnuting naradigm an	d cloud computing							
2 Understand the at	chitecture of cloud co	muting							
2. Understand the di	se the service models	and deployments							
5. Understand and use the service models and deproyments									
4. WOR On any real	rvice management an	d socurity of cloud							
J. Onderstand the se		a security of cloud							
10. Course Outcomes	(COs):								
The students w	ill be able to:-								
1. Clarify the diffe	rent definitions of c	loud computing and its c	haracteristics.						
2. Explain the prin	ciples of hardware v	virtualization and its impo	ortance for cloud o	2. Explain the principles of hardware virtualization and its importance for cloud computing.					
3 Motivate the importance of data centers for clouds, and explain how to design and construct a									
3. Motivate the im	portance of data cen	ters for clouds, and expla	ain how to design	and construct a					
3. Motivate the im data center.	portance of data cen	ters for clouds, and expla	ain how to design	and construct a					
3. Motivate the im data center.	portance of data cen	ters for clouds, and expla	ain how to design	and construct a					
3. Motivate the im data center.11. Unit wise detailed	portance of data cen	ters for clouds, and expla	ain how to design	and construct a					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 	content Number of	ters for clouds, and expla	ain how to design	and construct a					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 	content Number of lectures = 9	ters for clouds, and expla	ain how to design	and construct a					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov 	content Number of lectures = 9 erview of computing	ters for clouds, and expla-	ain how to design	and construct a					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview or computing. 	content Number of lectures = 9 erview of computing f cloud computing, 0	ters for clouds, and expla g paradigms, Recent trend Cloud computing-Concept	ain how to design ds in computing, o s, properties, chara	evolution of cloud acteristics, Role of					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c 	content Number of lectures = 9 erview of computing, opputing architectures	ters for clouds, and explain g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery	ain how to design ds in computing, o s, properties, chara models (XAAS), (evolution of cloud acteristics, Role of Cloud Deployment					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models 	content Number of lectures = 9 erview of computing f cloud computing, omputing architecture	ters for clouds, and expla- ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery	ds in computing, of s, properties, chara models (XAAS), (evolution of cloud acteristics, Role of Cloud Deployment					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 	content Number of lectures = 9 erview of computing, or omputing architecture Number of Number of	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery	ds in computing, of s, properties, chara models (XAAS), (evolution of cloud acteristics, Role of Cloud Deployment					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 	content Number of lectures = 9 erview of computing f cloud computing, omputing architecture Number of lectures = 9	ters for clouds, and explained and explain terms for clouds, and explain terms of the second second terms of the second s	ain how to design ds in computing, o s, properties, chara models (XAAS), (evolution of cloud acteristics, Role of Cloud Deployment					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE 	content Number of lectures = 9 erview of computing f cloud computing, on omputing architecture Number of lectures = 9 AS A SERVICE Interview	ters for clouds, and expla- ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery	ain how to design ds in computing, o s, properties, chara models (XAAS), (eesource virtualizati	evolution of cloud acteristics, Role of Cloud Deployment ion, Examples,					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS 	content Number of lectures = 9 erview of computing f cloud computing, of omputing architecture Number of lectures = 9 AS A SERVICE Inte	ters for clouds, and expla- ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery troduction, Hypervisors, R	ds in computing, of s, properties, chara models (XAAS), (essource virtualizati	evolution of cloud acteristics, Role of Cloud Deployment ion, Examples,					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS PLATFORM AS A SE implement DAAS 	content Number of lectures = 9 erview of computing, of omputing architecture Number of lectures = 9 AS A SERVICE Introduction,	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery troduction, Hypervisors, R Cloud Platform and Mana	ain how to design ds in computing, o s, properties, chara models (XAAS), (esource virtualization agement, Examples,	evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, How to					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS PLATFORM AS A SE implement PAAS SOFTWARE AS A SE 	content Number of lectures = 9 erview of computing f cloud computing, on omputing architecture Number of lectures = 9 AS A SERVICE Introduction, RVICE Introduction	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery troduction, Hypervisors, R Cloud Platform and Mana	ds in computing, of s, properties, chara models (XAAS), (essource virtualization gement, Examples, Web OS, Examples,	evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, How to					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS PLATFORM AS A SE implement PAAS SOFTWARE AS A SE implement SAAS 	content Number of lectures = 9 erview of computing f cloud computing, of omputing architecture Number of lectures = 9 AS A SERVICE Introduction, RVICE Introduction,	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery troduction, Hypervisors, R Cloud Platform and Mana Web services, Web 2.0, V	ds in computing, of s, properties, chara models (XAAS), (essource virtualization gement, Examples, Veb OS, Examples,	and construct a evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, How to How to					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Oversity of the open standards. Cloud centre of the open standards. Cloud centre of the open standards. Cloud centre open standards. Cloud centre	content Number of lectures = 9 erview of computing f cloud computing, 0 omputing architecture Number of lectures = 9 AS A SERVICE Introduction, RVICE Introduction,	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery troduction, Hypervisors, R Cloud Platform and Mana Web services, Web 2.0, V	ain how to design ds in computing, o s, properties, chara models (XAAS), (cesource virtualization gement, Examples, Veb OS, Examples,	and construct a evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, How to How to					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS PLATFORM AS A SE implement PAAS SOFTWARE AS A SE implement SAAS Unit – 3 	content Number of lectures = 9 erview of computing f cloud computing, on omputing architecture Number of lectures = 9 AS A SERVICE Introduction, RVICE Introduction, RVICE Introduction, Number of Introduction,	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery troduction, Hypervisors, R Cloud Platform and Mana Web services, Web 2.0, V	ain how to design ds in computing, o s, properties, chara models (XAAS), o eesource virtualization agement, Examples, Veb OS, Examples,	and construct a evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, . How to How to					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS PLATFORM AS A SE implement PAAS SOFTWARE AS A SE implement SAAS Unit – 3 	content Number of lectures = 9 erview of computing f cloud computing, of omputing architecture Number of lectures = 9 AS A SERVICE Introduction, RVICE Introduction, RVICE Introduction, Number of lectures = 9	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery troduction, Hypervisors, R Cloud Platform and Mana Web services, Web 2.0, W	ds in computing, of s, properties, chara models (XAAS), (essource virtualization gement, Examples, Veb OS, Examples,	and construct a evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, . How to How to					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION Ov computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS PLATFORM AS A SE implement PAAS SOFTWARE AS A SE implement SAAS Unit – 3 SERVICE MANAGEM 	content Number of lectures = 9 erview of computing f cloud computing, 0 omputing architecture Number of lectures = 9 AS A SERVICE Introduction, RVICE Introduction, RVICE Introduction, Number of lectures = 9 ENT IN CLOUD CO	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery croduction, Hypervisors, R Cloud Platform and Mana Web services, Web 2.0, V	ain how to design ds in computing, o s, properties, chara models (XAAS), (cesource virtualization gement, Examples, Veb OS, Examples,	and construct a evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, . How to How to					
 3. Motivate the im data center. 11. Unit wise detailed Unit-1 INTRODUCTION OV computing, Overview of open standards.Cloud c models Unit – 2 INFRASTRUCTURE How to implement IAAS PLATFORM AS A SE implement PAAS SOFTWARE AS A SE implement SAAS Unit – 3 SERVICE MANAGEM Management. Service 	content Number of lectures = 9 erview of computing f cloud computing, 0 omputing architecture Number of lectures = 9 AS A SERVICE Introduction, RVICE Introduction, RVICE Introduction, Number of lectures = 9 ENT IN CLOUD CC Level Agreements	ters for clouds, and expla- g paradigms, Recent trend Cloud computing-Concept e, Cloud service delivery croduction, Hypervisors, R Cloud Platform and Mana Web services, Web 2.0, V MPUTING Service Orche SLAs), Billing & Acco	ain how to design ds in computing, of s, properties, chara models (XAAS), of tesource virtualization gement, Examples, Veb OS, Examples, veb OS, Examples, comparing	and construct a evolution of cloud acteristics, Role of Cloud Deployment ion, Examples, . How to How to How to					

Unit _ 4	Number of					
Omt – 4	lectures – 9					
CLOUD SECURITY	Infrastructure security	2 Data Security, Storage Identity and Access Management				
Access Control Trust and Reputation Authentication in Cloud computing						
CASE STUDY ON O	DEN SOLIDCE ANI	DEAL CLOUD SERVICS Eventual VMware Cloud				
IPM Pluomix Coogle (Ten SOURCE AN	on Web services				
IDM Diueinix, Google C	liouu sei vices, Amazo	in web services				
12 Drief Decomination	of colf looming / F	harming component				
The students will be a	of sen-learning / E	-learning component				
The students will be en	ncouraged to learn u	Ising the SGT E-Learning portal and choose the relevant				
lectures delivered by s	ubject experts of SC	of University.				
The link to the E-Lear	ning portal.					
https://elearning.sgtun	iversity.ac.in/course	-category/				
13. Books Recommen	nded					
Text Books						
• . Barrie Sosinsky	: "Cloud Computing E	Bible", Wiley-India, 2010				
14. Reference Books						
. RajkumarBuyya	, James Broberg, And	rzej M. Goscinski: "Cloud Computing: Principles and Paradigms",				
Wiley, 2011	C C					
Nikos Antonopou	llos, Lee Gillam: "Clo	ud Computing: Principles, Systems and Applications", Springer,				
2012						
• Ronald L. Krutz,	Russell Dean Vines: '	Cloud Security: A Comprehensive Guide to Secure Cloud				
Computing" Wil	J 1' 0010					

• Tim Mather, Subra Kumara swamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'Reilly Media, 2009.

Cloud Security Essentials Lab

1. Name of the Department- Computer Science & Engineering						
2. Course	Cloud Security	L	Т		Р	
Name	Essentials Lab					
3. Course		3	0		2	
Code						
4. Type of Course (use tick mark)		Core (D)	PE (□)		OE ()	
5. Pre-	iOS Basics	6. Frequency (use	Even	Odd	Either	Every
requisite		tick marks)	(□)	0	Sem.()	Sem. ()
(ifany)						
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)						
Lectures = ()	Tutorials = 0	Pra	ctical = 1	10	

8. Course Description

This course will walk you through the process of identifying security issues on Android and iOS applications, using a wide variety of techniques including Reverse Engineering, Static/Dynamic/Runtime and Network Analysis.

- 13. Learning Objectives:
 1. Teaches students Cloud programming.
 2. Teaches you how to implement cloud devices.
 3. Teaches give you a knowledge of cloud infrastructure.
 4. You can memorize to pass a multiple-choice test.

10. Course Outcomes (COs):

The students will be able to:-

- To acquaint students with the practical aspects of Design.
 To understand the importance of User engagement and Experience.
 To learn various development technique

11. Lab Experiments

Sr. No.	Title	
		CO
1	To Identify users and manage their access.	
2	Learn to Protect applications and data, with appropriate security controls across network, data, and application access	1,2
3	Learn to Gain visibility and insights into security, compliance, and threat posture.	
4	To Inject security-based principles into the development and operation of cloud- based services.	1,3
5	To learn to design laaS, PaaS and SaaS architecture	
6	To design a Cloud Ecosystem.	
7	To learn Workload protection, integrated with DevSecOps	
8	To implement security posture and compliance management	
9	To implement Threat management	

AIML

Neural Network And Deep Learning

Name of the Dep	artment- Computer Scie	ence & Engineering					
2. Course	Neural Network	L	Т	Р			
Name	And Deep Learning						
3. Course Code		3	0	2			
4. Type of Cours	4. Type of Course (use tick mark) $Core(\checkmark)$ $PE(\checkmark)$ $OE()$						
5. Pre-requisite	NIL	6. Frequency (use tick	Even Odd	Either Every			
(if any)		marks)	0 (1)	Sem Sem			
7. Total Number	7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)						
Lectures = 36	· · · ·	Tutorials = 0	Practical = 0	,			
8. Course Descri	ption		I				
A convolutional	deen learning neural ne	twork is built using Keras	to show how	deen learning is			
used in specialize	ed neural networks. This	s course provides the nece	ssary required	background to			
understand ROI'	s Time Series Analysis	and Natural I anguage Pro	cessing course	s such ground to			
9 Learning object	rtives.	and Matural Danguage 110					
1 Understa	nd the context of neural	networks and deen learning	ισ				
2 Know ho	w to use a neural netwo	rb	15				
2. Know no 3. Understa	nd the data needs of dee	n learning					
J. Understan	orking knowledge of ne	p learning	arnina				
4. Have a w	orking knowledge of he	urar networks and deep lea	arning				
5. Explore t	ne parameters for neura	Inetworks					
10 Course Outer	(CO_2)						
10. Course Outco	omes (COs):						
1. To introd	uce the fundamental tec	hniques and principles of	Neural Networ	rks			
2. To study	the different models in A	ANN and their application	S				
3. To famili	arize deep learning cond	cepts with Convolutional N	Neural Networ	k case studies			
11. Unit wise det	ailed content						
Unit-1	Number of lectures =						
	10						
The neural netw	vork: The neuron, linear	r perceptron, feed-forward	neural networ	k, limitations of			
linear neurons, si	igmoid, tanh, relu neuro	ns, softmax output layer, i	nformation the	eory, cross			
entropy, Kullbac	k-Leibler divergence						
Training feed-fo	orward neural network	: Gradient Descent, delta	rules and learn	ning rates,			
gradient descent	with sigmoidal neurons	, the backpropagation algo	orithms, stocha	stic and			
minibatch gradie	nt descent, test sets, vali	idation sets and overfitting	, preventing o	verfitting			
	·			-			
Unit – 2	Number of lectures =						
	9						
TensorFlow: Co	omputation graphs, graph	hs, sessions and fetches, c	onstructing and	d managing			
graph, flowing tensors, sessions, data types, tensor arrays and shapes, names, variables.							
placeholders and	placeholders and simple optimization, linear regression and logistic regression using tensorflow						
Implement Neural Network: Introduction to Keras, Build neural network using Keras.							
Evaluating models, data preprocessing, feature engineering, feature learning, overfitting.							
underfitting, wei	ght regularization, drop	out, universal workflow of	f deep learning	-			
	NT 1 01	Γ					
Unit - 3	Number of lectures =						
	8	.					
Moving beyond	gradient descent: Loca	al minima vs global minim	na vs saddle, m	nodel			
Identifiability, co	identifiability, correcting gradient points in wrong directions, Momentum based optimization,						

second order methods, learning rate adaption, adagrad, rmsprop, adam **Convolutional Neural Network**: Convolution operation, filters and feature maps, motivation, sparse interactions, parameter sharing and equivariant representation, padding and stride, max pooling, full architectural description of convolutional network, build cnn using data augmentation, using pretrained convnet, visualize what convnet learn.

Unit – 4	Number of lectures =
	9

Embedding and Representation Learning: Principle component analysis, working with text data, one-hot encoding of words and characters, word embedding, autoencoder architecture, denoising, sparsity, Word2vec framework, Skip-Gram architecture.

Models for Sequence Analysis: Analysing Variable-length inputs, Seq2seq with neural n-gram, part of speech tagger, dependency parse, syntaxnet, recurrent neural network, challenges with vanishing gradients, long short term memory units

13. Books Recommended

Text Books

1. CharuC.Aggarwal "Neural Networks and Deep learning" Springer International Publishing, 2018

2. Satish Kumar, "Neural Networks, A Classroom Approach", Tata McGraw -Hill, 2007.

3. Simon Haykin, "Neural Networks, A Comprehensive Foundation", 2nd Edition, Addison Wesley Longman, 2001.

Reference Books

Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006 2. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000.

1. Name	of the D	epartment-	Comput	er Science & Engineering		•		
2. Cours	se Name Neural		L	Т	P			
	Network and		nd					
		Deep						
		learning La	ab					
	<u>a</u> 1				0			
3. Cours	se Code			3	0	2		
4.00	8.0		•					
4. Type of	of Cours	se (use tick n	nark)	Core (✓)	$PE(\checkmark)$			F
5. Pre-re	quisite			6. Frequency (use	Even	Odd Eith	her	Every
(II any) 7 Total	Numbor	of Looturos	Tutori	uck marks)		(\mathbf{v}) Set	II() m)	Sell()
7. Iulai		of Lectures	Tutori	als, I factical (assuming 12 als $= 0$	Practic	al – 10	1)	
8 Cours	e Descri	ntion	1 01011		Tractic	ai – 10		
This course	e Descri	ption	learning	algorithms the problem settin	as and th	air applications	toso	lvo rool
world pro	blems	iee major deep) icarining	argorithms, the problem settin	gs, and in	en applications	5 10 50	ive rear
world pro	orems.							
	~ Ohior	4						
9.Learnin	ig Objec	introduction	to the f	iald of artificial naural nat	worka	nd machina l	aarni	na
1. to pro	vide all	nta hour to a		ield of artificial neural neu	works a	nu machine i	ahni	ing;
2. to teac	tion:	ints now to s	orve pra	ictical problems via imple.	mentatic	on of these te	chinic	jues via
Sillura 2 to mag	alloll, moto fu	uth an indana	ndant la	aming on the tonics of art	ficial m	unal natural	70.010	4
5. to pro	mole Iu	riner indepe	ndent le	arning on the topics of art	menar ne	eural network	s and	u
macm	ne lean	nng,						
10. Cour	se Outc	omes (COs):						
The stude	ents will	be able to:-						
1. Under	stand th	ne characteri	stics and	d types of artificial neural	network	and rememb	ber w	orking
of bio	logical	Neuron and	Artificia	al Neural Network.				-
2. Apply	learnin	g algorithms	s on per	ceptron and apply back pro	opagatio	n learning or	n Net	ıral
Netwo	ork.							
3. Apply	y Feedb	ack NN and	plot a E	oltzmann machine and as	sociative	e memory on	vari	ous
applic	ation .							
11. Lab	Experin	nents						
Sr.No	Topics	8						~~~
								CO
1	To Wr	ite a program t	o implen	ent Perceptron.				
2	To wri	te a program to	o implem	ent AND OR gates using Perce	eptron			
3	To imp	element Crab C	Classifica	tion using pattern net				
4	To wri	te a program te	o implem	ent Wine Classification using I	Back prop	agation.		
5	To wri	te a MatLab S	cript cont	aining four functions Addition,	Subtracti	on, Multiply a	nd	
	Divide	functions						3
6	Write a	a program to ir	nplement	classification of linearly separ	able Data	with a		2.2
7	percep	tron	T)(2,3
/	To stue	ay Long Short	Term Me	emory for Time Series Prediction	on	1		
8	To stud	ay Convolution	nal Neura	I Network and Recurrent Neur	al Networ	К		
9	To stu	ay ImageNet, (GoogleNe	et, KesNet convolutional Neura	I Networl	KS		
10	To stud	y the use of Lo	ong Short	Term Memory / Gated Recurr	ent Units	to predict the s	tock	1 2
	prices based on historic data 1,2					1,4		

Name of the Department- Computer So	cience & Engineering				
2. Course Data Science Tools	L	Т		Р	
Name And Techniques					
3 Course	3	0		2	
Code	5	U		-	
4. Type of Course (use tick mark)	Core (✓)	PE(√))	OE ()	
5. Pre- NIL	6. Frequency (use tick	EveOdEitheEve			Ever
requisite (if	marks)	n (d	r Sem	У
any))	(√)	0	Sem
					0
7. Total Number of Lectures, Tutorials	, Practical (assuming 12	weeks	of one	semester	r)
Lectures = 36	Tutorials = 0	Practi	cal = 0)	
8. Course Description					
The student learns the architecture of HDE	S and ManReduce along w	ith othe	r tools s	such as ni	σ hive
spark, Zookeeper, HBase	b and mapreeduce along w			juen us pi	5, 111,0,
9. Learning objectives:					
1. The objective of this course is to tea	ach students the conceptua	l framev	vork of	Big Data	,
2. Learn Virtualization, MapReduce,	HDFS			U	
3. Learn Pig, Hive, Spark, ZooKeeper	, HBase.				
10. Course Outcomes (COs):					
On completion of this course, the students	s are expected to learn				
1. Concepts of Hadoop and HDFS	1				
2. Concepts of Map Reduce					
3. Big data tools Pig, Hive, Spark, Zoo	okeeper, HBase				
11. Unit wise detailed content					
Unit-1 Number of lectures =					
Big Data: Fundamentals of Big Data, de	fining big data, building s	uccessf	ul big o	lata	
management architecture, big data journe	y		-		
Big Data Types: Structured and unstruct	ured data types, real time	and nor	n-real t	ime	
requirements					
Distributed Computing: History of distr	ributed computing, basics	of distr	ibuted	computin	g
Unit -2 Number of lectures = 9					
Big Data Technology Foundation: Big	Data stack, redundant phy	vsical in	frastru	cture, sec	urity
infrastructure, operational databases, orga	anising data services and t	ools, ar	alytica	l data	2
warehouse, big data analytics	e	,	5		
Virtualization: Basics of virtualization, 1	hypervisor, abstraction an	d virtua	lizatio	n, implen	nenting
virtualization with big data					-
Cloud and Big Data: Defining cloud, clo	oud deployment and delive	ery mod	lels, clo	oud as an	
imperative for big data, use the cloud for	big data				
Unit – 3 Number of lectures =					
Onerational Databases: Relational data	base nonrelational databa	ne keu	valua	noir datal	
- Speranonal Databases - Relational data	DASE HOILEIALIONAL DATA	1.51. 61.0	- • • • • • • •	ימומים המו	nases

MapReduce Fundamentals: Origin of MapReduce, map function, reduce function, putting map and reduce together, optimizing map reduce

Hadoop: Discovering Hadoop, Hadoop distributed file system, Hadoop MapReduce, Hadoop file system, dataflow, Hadoop I/O, data integrity, compression, serialization, file-based data structure

Unit – 4	Number of lectures =
	9

Avro: Avro data types and schemas, in-memory serialization and deserialization, avro datafiles, schema resolution

Pig: Comparison with databases, pig latin, user defined functions, data processing operators **Hive:** Running hive, comparison with traditional databases, HiveQL, tables, querying data, user-defined functions

Spark: Resilient distributed datasets, shared variables, anatomy of a spark job run, executors and cluster managers,

HBase:HBasics, concepts, clients, HBase vs RDBMS, Praxis

ZooKeeper:ZooKeeper services, building application with ZooKeeper

13. Books Recommended

Text Books

Hadoop: The Definitive Guide, 4th Edition by Tom White - Shroff Publishers & Distributers Private Limited - Mumbai; Fourth edition (2015)

Reference Books

Big Data: Principles and Best Practices of Scalable Real-time Data Systems by James Warren and Nathan Marz, Manning Publications (2015) On Writing Well. William Zinsser. Harper Resource Book. 2001

Data Science tools and techniques Lab

1. Name of the De	partment- Computer Science & Eng	ineering			
2. Data Scie	ence L	Т		Р	
Course tools and					
Name technique	es Lab				
3.	3	0		2	
Course					
Code					
4. Type of Course	e (use tick Core (\checkmark)	PE(√)		OE ()	
mark)		F	011	Etthern	F
5. Pre-	6. Frequency (use	Even		Either	Every
to (if	uck marks)	0	(•)	Sem()	Sem ()
anv					
)					
7. Total Number of	of Lectures, Tutorials, Practical (ass	uming 12 weeks o	f one se	mester)	
Lectures = 0	Tutorials = 0	Practic	al = 10		
8. Course Descrip	tion				
This course provides	the data and study data modeling to draw	useful information	out of the	data, which	h is
conclusive and helps	in decision making for a certain problem	or query.			
Learning Objectiv	ves:				
1. Understand t	he R Programming Language.				
2. Exposure on	Solving of data science problems.				
3. Understand	The classification and Regression Model.				
10. Course Outco	mes (COs):				
The students will b	be able to:-				
1. Understand th	ne features of R Programming Language.				
I	a statistical techniques in P				
2. Understandin	g statistical techniques in K				

11. Lab Experiments

Sr.No	Topics	СО
1	R AS CALCULATOR APPLICATION	
	a. Using with and without R objects on console	1
	b. Using mathematical functions on console	
	c. Write an R script, to create R objects for calculator application and save in a specified	
	location in disk.	
2	DESCRIPTIVE STATISTICS IN R	
	a. Write an R script to find basic descriptive statistics using summary, str, quartile	1,2
	function on mtcars& cars datasets.	
	b. Write an R script to find subset of dataset by using subset (), aggregate () functions	
	on iris dataset.	
3	READING AND WRITING DIFFERENT TYPES OF DATASETS	
	a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file	2
	in specific disk location.	

	b. Reading Excel data sheet in R.	
	c. Reading XML dataset in R.	
4	VISUALIZATIONS	
	a. Find the data distributions using box and scatter plot.	1,3
	b. Find the outliers using plot.	
	c. Plot the histogram, bar chart and pie chart on sample data.	
5	CORRELATION AND COVARIANCE	
	a. Find the correlation matrix.	3
	b. Plot the correlation plot on dataset and visualize giving an overview of relationships	
	among data on iris data.	
	c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris	
	data.	
6	REGRESSION MODEL	
	Import a data from web storage. Name the dataset and now do Logistic Regression to	2,3
	find out relation between variables that are affecting the admission of a student in a	
	institute based on his or her GRE score, GPA obtained and rank of the student. Also	
	check the model is fit or not. Require (foreign), require (MASS)	
7	MULTIPLE REGRESSION MODEL	
	Apply multiple regressions, if data have a continuous	3
	Independent variable. Apply on above dataset.	
8	REGRESSION MODEL FOR PREDICTION	
	Apply regression Model techniques to predict the data on above dataset	1
9	CLASSIFICATION MODEL	
	a. Install relevant package for classification.	2
	b. Choose classifier for classification problem.	
	c. Evaluate the performance of classifier.	
10	CLUSTERING MODEL a. Clustering algorithms for unsupervised classification. b. Plot	
	the cluster data using R visualizations	1,2

Data Visualization

Name of the Dep	partment- Computer S	cience & Engineering									
2. Course	Data Visualization	L	Т		Р						
Name											
		2	0		2						
3. Course Code		3	0		2						
4 Type of Cour	se (use tick mark)	Core (12)	PE(v		OE ()						
5 Pre-requisite	NIL	6 Frequency (use tick	Even	, Odd	Fither	Every					
(if any)		marke)			Sem	Sem					
(II dily)		marks)	()	U U		\bigcirc					
7. Total Number	r of Lectures. Tutorial	s. Practical (assuming 12	weeks	of one	semestei	·)					
Lectures $= 36$,,	Tutorials = 0	Practic	cal = 0)					
8. Course Descr	iption		110001								
Data visualizatio	on techniques allow peo	nle to use their perception	to bette	er unde	rstand thi	s data					
The goal of this of	course is to introduce st	idents to data visualization	n includ	ing bot	h the nri	ncinles					
and techniques	Students will learn the v	value of visualization spec	rific tec	hniques	in infor	mation					
visualization and	scientific visualization	and how understand how	to best	lovora	a vienal	ization					
methods	i scientific visualization	, and now understand now		ic vera	ge visual	Zation					
0 Loorning obj	ootivoo										
9. Learning obje	the various types of date	annly and avaluate the r	rincinlo	s of da	ta vicuali	zation					
1. 10 understand	the various types of data	a, apply and evaluate the p		s of ua	dotogot	Zation.					
2. Acquire skins	to apply visualization te	offective viewelizations the	L IIS ass		uataset.	otion					
5. To apply struc	aured approach to create	e effective visualizations th	hereby t	Junani	g visualiz	ation					
dashboard to sup	port decision making.										
10. Course Out	comes (COS):										
1. Identify the di	fferent data types, visua	lization types to bring out	the insi	ght. Re	late the						
visualization tow	ards the problem based	on the dataset.									
2. Identify the di	ifferent attributes and sh	owcasing them in plots. I	dentify a	and cre	ate variou	15					
visualizations for	r geospatial and table da	ta.									
3. Ability to visu	alize categorical, quanti	tative and text data. Illust	rate the	integra	tion of						
visualization too	ls with hadoop.										
4. Ability to visu	alize categorical, quanti	tative and text data									
11. Unit wise det	ailed content										
Unit-1	Number of lectures = 10										
Overview of Data	analysis, Introduction to	Data visualization. Worki	ng with	statistic	al formul	as -					
Logical and finan	cial functions. Data Val	idation & data models. Pow	er Man	for visi	alize dat	a.					
Power BI-Busine	ss Intelligence. Data Ana	alvsis using statistical meth	ods. Das	shboard	designin	g.					
	0		,		0						
Unit – 2	Number of lectures										
	= 9										
Heat Map, Tree N	Aap, Smart Chart, Azure I	Machine learning , Column	Chart, I	Line Ch	art, Pie, E	Bar,					
Area, Scatter Cha	rt, Data Series, Axes, Cl	nart Sheet, Trendline, Erro	or Bars,	Sparkli	nes,						
Combination Cha	rt, Gauge, Thermometer	Chart, Gantt Chart, Pareto	o Chart e	etc , Fre	quency						
Distribution, Pivo	ot Chart, Slicers, Tables:	Structured References, Tab	ole Style	s , Wha	t-If Analy	vsis:					
Data Tables, Goa	l Seek, Quadratic Equation	on, Transportation Problen	n, Maxir	num Fl	ow Proble	em,					
Sensitivity Analy	sis, Histogram, Descripti	ve, Statistics, Anova, F-Te	st, t-Test	t, Movi	ng, Avera	ige,					
Exponential Smo	othing Correlation mode	el Regression model				Exponential Smoothing Correlation model Regression model					

Unit – 3	Number of lectures	
	= 8	
What is Tableau?	What does the Tableau	product suite comprise of? How Does Tableau Work?
Tableau Architec	ture, What is My Tableau	Repository? Connecting to Data & Introduction to data
source concepts,	Understanding the Tablea	au workspace, Dimensions and Measures, Data Types &
Default Propertie	s, Building basic views, S	Saving and Sharing your work-overview
Unit – 4	Number of lectures	
	= 9	
Date Aggregation	ns and Date parts, Cross t	ab & Tabular charts, Totals & Subtotals, Bar Charts &
Stacked Bars, Tre	end lines, Forecasting, Fil	ters, Context filters, Line Graphs with Date & Without
Date, Tree maps,	Scatter Plots	
13. Books Recor	nmended	
Text Books		
13. Books Reco	mmended	
I. "Information I	Dashboard Design: Displa	aying Data for At-a-glance Monitoring by Stephen Few
Edition, 2014.		
2. Y. Daniel Liang	g, Introduction to Java prog	gramming-comprehensive version-Tenth Edition, Pearson ltd
2015.		
Reference Books	8	
1. "Beautiful Visu	alization, Looking at Dat	a Through the Eyes of Experts by Julie Steele, Noah

Iliinsky" 2. "The Accidental Analyst: Show Your Data Who's Boss" by Eileen and Stephen McDaniel

Data Visualization Lab

1. Name	e of the Department-	Computer Science & Engineer	ring			
2.	Data	L	T		Р	
Course	Visualization					
Name	Lab					
3.		3	0		2	
Course						
Code						
4. Type	of Course (use tick	Core (🗸)	PE(√)		OE ()	
mark)						<u> </u>
5. Pre-		6. Frequency (use	Even	Odd	Either	Every
requisi		tick marks)	(*)	0	Sem()	Sem()
te (if						
)						
/ 7 Total	Number of Lectures	Tutorials Practical (assumin	σ 12 weeks o	of one ser	nester)	<u> </u>
$\frac{1}{1} = \frac{1}{1}$						
Lecture	es = 0	Tutorials = 0	Practic	al = 10		
Lecture 8. Cour	s = 0 se Description	Tutorials = 0	Practic	cal = 10		
Lecture 8. Cour This cour	s = 0 se Description rse will cover introduction	Tutorials = 0on to data visualization, where stud	ent will learn l	cal = 10	sign, build,	and
Lecture 8. Cour This cour evaluate	s = 0 $se Description$ $rse will cover introductivisualizations for difference of the second seco$	Tutorials = 0 on to data visualization, where student types of data, disciplines, and defined as the student types of data.	ent will learn lomains	cal = 10	sign, build,	and
Lecture 8. Cour This cour evaluate	s = 0 se Description rse will cover introductivisualizations for different	on to data visualization, where student types of data, disciplines, and details d_{1}	ent will learn l	cal = 10	sign, build,	and
Lecture 8. Court This court evaluate 14. Lean	s = 0 $se Description$ $rse will cover introductives for difference of the second s$	Tutorials = 0 on to data visualization, where student types of data, disciplines, and defined the student types of data.	ent will learn lomains	cal = 10	sign, build,	and
J. TotalLecture8. CourtThis courtevaluate14. Lean1. Example	s = 0 $se Description$ $rse will cover introductives for difference of the second s$	Tutorials = 0 on to data visualization, where student types of data, disciplines, and deduced data	ent will learn lomains	cal = 10	sign, build,	and
Jecture8. CourtThis courtevaluate14. Lear1. Example2. Example	se Description rse will cover introduction visualizations for different rning Objectives: xplain how visualize the xplain how to use the Ge	Tutorials = 0 on to data visualization, where stud ent types of data, disciplines, and de data eospatial Data data.	ent will learn lomains	cal = 10	sign, build,	and
J. TotalLecture8. CourtThis courtevaluate14. Lean1. Ex2. Ex3. Ex	ss = 0 se Description rse will cover introduction visualizations for different rning Objectives: xplain how visualize the xplain how to use the Generation xplain how to use the construction xplain how t	Tutorials = 0 on to data visualization, where student types of data, disciplines, and deduced data data eospatial Data data. lor in good design.	ent will learn lomains	cal = 10	sign, build,	and
J. TotalLecture8. CourThis courevaluate14. Lean1. Ex2. Ex3. Ex	s = 0 $se Description$ $rse will cover introductivisualizations for difference of the second seco$	Tutorials = 0 on to data visualization, where student types of data, disciplines, and dedata data eospatial Data data. lor in good design.	ent will learn lomains	cal = 10	sign, build,	and
J. IotalLecture8. CourtThis courtevaluate14. Lean1. Ex2. Ex3. Ex10. Court	ss = 0 se Description rse will cover introductivisualizations for different rning Objectives: xplain how visualize the xplain how to use the Generation of the council	Tutorials = 0 on to data visualization, where stud ent types of data, disciplines, and de data eospatial Data data. lor in good design.	ent will learn lomains	cal = 10	sign, build,	and
J. IotalLecture8. CourtThis courtevaluate14. Lean1. E22. E33. E310. CoutThe stude1. Under	s = 0 $se Description$ $rse will cover introductivity visualizations for different visualizations fo$	Tutorials = 0 on to data visualization, where stud ent types of data, disciplines, and do data eospatial Data data. lor in good design.	ent will learn lomains	cal = 10	sign, build,	and
J. TotalLecture8. CourThis courevaluate14. Lean1. En2. En3. En10. CourThe student1. Under2. Implet	s = 0 $se Description$ $rse will cover introductivisualizations for difference of the second seco$	Tutorials = 0 on to data visualization, where stud ent types of data, disciplines, and de data eospatial Data data. lor in good design. ualization tributions	ent will learn lomains	cal = 10	sign, build,	and
J. IotalLecture8. CourThis courevaluate14. Lear1. E22. E33. E210. CourThe stude1. Under2. Impler3. Write	s = 0 $se Description$ $rse will cover introductivity visualizations for different visualization for different visualization visualization visualization of disprograms on visualization visua$	Tutorials = 0 on to data visualization, where stud ent types of data, disciplines, and de data eospatial Data data. lor in good design. ualization tributions. on of time series, proportions & ass	ent will learn lomains	cal = 10	sign, build,	and
J. TotalLecture8. CourThis courevaluate14. Lean1. En2. En3. En10. CourThe stude1. Under2. Implen3. Write4. Apply	s = 0 $se Description$ $rse will cover introductivisualizations for difference of the second seco$	Tutorials = 0 on to data visualization, where student types of data, disciplines, and deta data eospatial Data data. lor in good design. ualization tributions. on of time series, proportions & ass and uncertainty	ent will learn lomains	cal = 10	sign, build,	and

Sr.No	Topics	
		CO
		Covere
1	Download the House Pricing dataset from Kaggle and map the values to Aesthetics	
2	Use different Color scales on the Rainfall Prediction dataset	
3	Create different Bar plots for variables in any dataset	
4	Show an example of Skewed data and removal of skewedness	
5	For a sales dataset do a Time Series visualization	
6	Build a Scatterplot and suggest dimension reduction	
7	Use Geospatial Data-Projections on datasets in http://www.gisinindia.com/directory/gis- data-for-india	3
8	Create the a trend line with a confidence band in any suitable dataset	
9	Illustrate Partial Transparency and Jittering	
10	Illustrate usage of different color codes	

IoT

Design of Smart Systems

1. Name of the Department- Computer Science & Engineering								
2. Course Name	Design of Smart	L	Т		Р			
	Systems							
3. Course Code	Code 3		0		2			
4. Type of Course (use tick mark)		Core (<i>\lambda</i>)	PE(✓)		OE ()			
5. Pre-requisite (if		6. Frequency (use	Even	Odd	Either	Every		
any)		tick marks)	0	(🗸)	Sem()	Sem()		
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)								
Lectures = 36	6 Tutorials = 0 Practical = 0							

8. Course Description

This course equips students with essential tools frequently used to impart intelligence to a variety of systems. Applications of these tools in the design and development of smart systems are illustrated.

15. LearningObjectives:

- 1. To develop an understanding of Smart Systems, their implementation and applications.
- 2. Interpret and explain the impact of Smart Systems, ethical, legal, social, environmental implications.
- 3. Explain concepts used in Smart Systems and associated architectures.
- 4. Explain the major Smart Systems application areas and techniques used within them

10. Course Outcomes (COs):

- Understand the basic principles behind smart systems.
- 1. Understand the interfacing between the sensors and MCU.
- 2. Understand the different control techniques.
- 3. Understand the communication for smart sensors

11. Unit wise detailed content

III onte wise detaned	content	
Unit-1	Number of lectures = 9	

INTRODUCTION TO SENSOR DEVICES : Piezoresistive pressure sensor- Piezoresistive Accelerometer -Capacitive Sensing- Accelerometer and Microphone - Resonant Sensor and Vibratory Gyroscope - Low-Power, Low Voltage Sensors- Micro Electro Mechanical Systems Analysis and Design of MEMS Devices-Nano Sensors

Unit – 2	Number of
	lectures = 9

INTERFACING SENSOR INFORMATION AND MCU: Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU ControlMCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration.

Unit – 3	Number of								
	lectures = 9								

CONTROL TECHNIQUES AND STANDARDS : Control of Sensors using - State Machines, Fuzzy Logic, Neural Networks, Adaptive Control. Control Application using - CISC, RISC, DSP Control and IEEE 1451 Standards

1. Unit – 4	Number of
	lectures = 9

COMMUNICATION FOR SMART SENSORS:Wireless Data Communications- RF Sensing-Telemetry- Automotive Protocols- Industrial NetworksHome Automation- MCU Protocols. PACKAGING, TESTING AND RELIABILITY IMPLICATIONS OF SMART SENSORS: Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors- Reliability ImplicationsTesting Smart Sensors-HVAC Sensor Chip.

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/course-category/

13. Books Recommended

Text Books

- Randy Frank, "Understanding Smart Sensors", Artech House, Second Edition, 2011Boston,
- Minhang Bao, "Analysis and design principles of MEMS devices", Elsevier Publications, 2005, USA.
- Nadim Maluf and Kirt Williams, "An Introduction to Micro Electro Mechanical Systems Engineering", Second Edition, Artech House Publishers, June 2004, USA

14. Reference Books

- Gabriel M. Rebeiz, "RF MEMS: Theory, Design, and Technology", Wiley-Interscience; 1st edition, 2002,UK
- John A. Pelesko and David H. Bernstein, "Modeling MEMS and NEMS", CRC Press, 2002,UK
- Rai-choudhury, "MEMS and MOEMS Technology and Applications", PHI, 2010.

Design of Smart Systems Lab

1. Name of the Department- Computer Science & Engineering									
2. Course Name	Design of Smart	L	Т						
	Systems								
	Lab								
3. Course Code		3	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)	0	(✔)	Sem()	Sem ()			
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)									
Lectures = 36		Tutorials = 0	Practic	al = 0					
8. Course Description	1								

This course introduces the basic of Arduino/Raspberry Pi. And programming on it.

16. LearningObjectives:

- 1. To study IOT, their charactersics of components and basic awareness of Arduino/Raspberry Pi.
- 2. To study various supporting OS platforms for Raspberry-Pi /Beagle board
- 3. To study the fundamentals of connectivity schemes of Raspberry-Pi /Beagle board
- 4. To facilitate the development and application of problem-solving skills instudents.

10. Course Outcomes (COs):

The students will be able to:-

- 1. understand IOT, Arduino/Raspberry Pi, and also able to install software setup of Arduino/Raspberry Pi.
- 2. understand the different supporting OS platforms of Raspberry-Pi /Beagle board
- 3. use Raspberry-Pi /Beagle board circuit with external resources

11. Unit wise detailed content

11. U	int wise detaned content							
Unit-	1 Number of							
	lectures = 9							
1.	Familiarization with concept of IOT, Arduino/Raspberry Pi and perform necessary software installation							
2.	Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS							
	installation on Raspberry-Pi /Beagle board							
3.	Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals,							
	LEDS. Understanding GPIO and its use in program.							
4.	Use of Temperature Sensor and LED bar.							
5.	Use of IR(Infra red) Sensor and LED bar							
6.	Use of Camera.							
7.	Use of X-Bee Module							
8.	Use of Stepper Motor							
9.	Client -Server Application							
10.	Raspberry Pi to Cloud Interfacing.							
12. B	rief Description of self-learning / E-learning component							
The st	tudents will be encouraged to learn using the SGT E-Learning portal and choose the relevant							
lectur	lectures delivered by subject experts of SGT University.							
The li	The link to the E-Learning portal.							
1								

https://elearning.sgtuniversity.ac.in/course-category/

Architecting Smart IoT Devices

1. Name of the Department- Computer Science & Engineering										
2. Course Name	Architecting	L	Т		Р					
	smart IoT									
	Devices									
3. Course Code		3	0		2					
4. Type of Course (u	ise 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 Lectures, Tutorials, Practical (assuming 12 weeks of one semester)										
Lectures = 36	Lectures = 36Tutorials = 0Practical = 0									
8. Course Description	on									
• This course wi	Il teach you how to o	develop an embedded syst	tems devi	ce. In orc	ler to redu	ice the				
time to market.	, many pre-made har	dware and software comp	ponents an	re availab	ole today.					
17. LearningObject	ves:									
1. Identify dif	terent IoT Applicati	ons with IoT architecture	•							
2. Identify, te	st and interconnect c	components/parts of IoT s	ystem.							
3. Identify a	nd test various parts	of embedded system.	~							
4. Identify and	d select various type	s of sensors used in Smar	t City.							
	(22.2.)									
10. Course Outcome	es (COs):									
1. Identify an	nd test Smart Lightin	ng system and its compon	ents							
2. Identify, s	elect, install and tro	ubleshoot different modul	le / device	es used in	I SMART	Street				
Light base	ed on IoT and Cloud	Technology.								
3. Identify, s	elect, install and tro	ubleshoot different modul	le / device	es used in	SMART	Parking				
4. Identify, s	elect, install and tro	ubleshoot different modul	le / device	es used in	SMART	Traffic.				
11. Unit wise detaile	d content	1								
Unit-1	Number of									
	lectures = 9									
Fundamentals of Iot	t 									
Evolution of Internet	of Things – Enablin	g Technologies – IoT Ar	chitecture	s: oneM2	2M, IoT V	Vorld				
Forum (IoTWF) and	Alternative IoT Mod	dels – Simplified IoT Arcl	hitecture a	and Core	IoT Func	tional				
Stack – Fog,										
Unit – 2	Number of									
	$\frac{ \text{lectures} = 9 }{ \text{lectures} = 1 $		0	A 4	1.0					
Edge and Cloud in Io	I – Functional Bloc	ks of an lol Ecosystem -	Sensors, A	Actuators	s, and Sm	art				
Objects – Open Hardware Platforms for IoT.										
Unit 3 Number of										
Unit -3	Number of									
	iectures = 9		T	() ()	1 4 **					
Kouting over Low Power and Lossy Networks (RPL) – Application Transport Methods: Application										
Layer Not Present, St	apervisory Control a	ing Data Acquisition (SCA	ada) -Aj	pplication	n Layer					
Protocols: COAP and MQ11 – Service discovery – mDNS.										
Unit - 4Number of lectures = 9										

Smart and Connected Cities: Street Layer, City Layer, Data Center Layer and Services Layer, Street Lighting, Smart Parking Architecture and Smart Traffic Control – Smart Transportation – Connected Cars.										
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/course-										
<u>category/</u>										
13. Books Recommended										
Text Books										
 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", CISCO Press, 2017. 										
14. Reference Books										
1. Perry Lea, "Internet of things for architects", Packt, 2018.										
2. Jan Ho"ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014.										
 Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key Applications and Protocols", Wiley, 2012. 										
 Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011. 										

	Architecting smart IoT Devices Lab	L (3)	T (0)		P (2)	
3. Course Code						
I. Type of Course	(use 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, Tutor	ials, Practical (a	assuming 12	weeks of o	one semester)	
\Box ectures = 0		Tutorials = 0	Practical =	48		
3. Brief Syllabus This course time to man	will teach you hov ket, many pre-mad ctives: lifferent IoT Applic	v to develop an e e hardware and s cations with IoT a	mbedded sys oftware com architecture. arts of IoT sy	stems devic ponents ar	e. In order to re e available toda	educe the
 18. Learning Object 1. Identify of 2. Identify, 3. Identify a 4. Identify a 	test and interconned and test various part and select various ty	ts of embedded s ypes of sensors u	ystem. sed in Smart	City.		

Sr. No.	Title							
1	Development Tools and Environments. Debugging Basics. Debugging Specials.							
2	Real-Time Scheduling. Synchronisation and Communication web tour. Device Drivers. Multithreading Design.							
3	Hardware & Software for EmS							
4	Study of a few Embedded Processor Families. MCU, SOC, FPGA. Cache, pipeline and coupling							
5	Networks. Software Components							
6	OS for IoTEvaluation reports on the embedded OS							

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

Application of IoT in Robotics

1. Name of the Depa	rtment- Computer	Science & Engineering									
2. Course Name	Application of	L	Т	Р							
	IoT in										
	Robotics										
3. Course Code		3 0 2									
4. Type of Course (u	ise tick mark)	Core (\checkmark)	PE (✓)	OE ()							
5. Pre-requisite (if		6. Frequency (use	Even Odd	Either Every							
any)		tick marks)	(✔) ()	Sem() Sem()							
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)											
Lectures = 36Tutorials = 0Practical = 0											
8. Course Description											
This course will teac	ch you how to develop	an embedded systems devi	ce. In order to reduc	e the time to							
market, many pre-m	ade hardware and soft	ware components are availa	ble today.								
	•										
19. Learning Object	ives:										
1. Identity diff	erent Io1 Applications	s with IoT architecture.									
2. Identity, test	and interconnect com	ponents/parts of IoT system	1.								
3. Identify an	d test various parts of	embedded system.									
4. Identify and	select various types of	f sensors used in Smart City	<i>.</i>								
40.0											
10. Course Outcome	es (COs):										
 Identify, sele based on IoT Identify, sele Identify, sele 	ect, install and trouble Γ and Cloud Technolo ect, install and trouble ect, install and trouble	shoot different module / dev gy. shoot different module / dev shoot different module / dev	vices used in SMAR vices used in SMAR vices used in SMAR	T Street Light T Parking T Traffic.							
11. Unit wise detaile	d content										
Unit-1	Number of lectures = 9										
What is the IoT and	why is it importan	1 ht? Elements of an IoT e	ecosystem Techr	ology drivers							
Rusiness drivers Ti	ends and implicati	ons Overview of Gove	rnance Privacy	and Security							
	ends and implicati		mance, i nvacy a	and Security							
155005											
Unit – 2	Number of										
	lectures = 9										
Protocol Standardiz	ation for IoT –Effe	orts -M2M and WSN P	rotocols –SCAD.	A and							
RFIDProtocols –Iss	ues with IoT Stand	lardization – Unified Da	ta Standards – Pr	otocols –							
IEEE802.15.4–BAC	CNet Protocol–Mod	dbus –KNX –Zigbee–N	etwork layer –A	PS layer –							
Security											
Unit – 3	Number of										
	lectures = 9										
IoT Open source are deployment models architecture-Resour	chitecture (OIC)-O -IoTivity : An Ope ce model and Abst	IC Architecture & Desi n source IoT stack -Over raction	gn principles-Io erview-IoTivity s	T Devices and stack							
2 II:4 1	Number of										
3. UIIII – 4	lectures = 9										

IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT-A, Hydra etc.

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/course-category/

13. Books Recommended

Text Books

4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", CISCO Press, 2017.

14. Reference Books

- 5. Perry Lea, "Internet of things for architects", Packt, 2018.
- 6. Jan Ho"ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014.
- 7. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things Key Applications and Protocols", Wiley, 2012.
- 8. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.

Application of IoT in Robotics Lab

1. Name of the Depar	tment- Computer S	Science & Engineering									
2. Course Name	Application of	L	Т		Р						
	IoT in										
	Robotics Lab										
3. Course Code		3	0		2						
4. Type of Course (us	e tick mark)	Core (✓)	PE (✓)		OE ()						
5. Pre-requisite (if	Computer Basics	6. Frequency (use	Even	Odd	Either	Every					
(\mathbf{x}) $($											
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)											
Lectures = 36		Tutorials = 0	Practic	al = 0							
8. Course Description	1	•									
This course will teach stu	udents how to use the	iot application in real time	applicatio	on. Studen	ts will des	ign					
different projects using A	Arduino/Raspberry										
20 LearningOhiectiv	7 65 •										
1 To understand	the basic functions (of Arduino/Raspherry									
2 To understand	the application of io	t in healthcare system									
3 To understand	the programming fu	nctions of Arduino									
4 To facilitate the	e development and a	application of problem-sc	lving ski	lle instud	ents						
		application of problem se	JIVING SKI	ns mstud	ents.						
10 Course Outcomes											
The students w	vill be able to:										
1 Understand the h		ahata									
1. Understand the t	basic components of r	odots.									
2. Differentiate typ	bes of robots and robot	t grippers.									
5. Programme a rol	bot to perform tasks in	n industrial applications.									
11. Unit wise detailed	content	1									
Unit-1	Number of										
	lectures = 9			<u>.</u>	. 11						
1. Familiarization	with Arduino/Raspb	erry PI and perform nece	essary sof \cdot_{i}	tware ins	tallation						
2. To interface LEI	D/Buzzer with Ardu	ino/Raspberry Pi and wr	ite a prog	ram to tu	rn ON LI	ED for					
1 sec alter every 2	seconds	and (ID/I DD) with Andre	in a /D a am	h	and services						
5. TO Interface Pus	M LED when much h	isol (IR/LDR) with Aldu	1110/Kasp	tion	ind write	a					
4 To interface DH	T11 concor with Ar	duing/Deenhormy Di and y	urita a pr	uon.	nuint						
4. TO Interface DH	midity readings	uuilla/Kaspberry Franu v	vine a pr	ogram to	print						
5 To interface mot	tor using relay with	Arduino/Pasnberry Di an	d write a	nrogram	to turn (N					
5. TO interface motor	utton is pressed	Alumo/Raspoenty 11 an	iu write a	program							
6 Students are en	couraged to explore	the surrounding problem	ns and dee	sign solut	ions hase	od on					
IoT for any 3 of the	e following	the surrounding problem		sign solu	lons base	u on					
i Health Monitorir	e following.										
ii Smart Irrigation	System using Clou	4									
iii Smart Wasta M	Janagement System	u									
iv Smart Street I	ights System										
v Fire and Smelle	Detection System										
v. File and Shoke	etection System	Water level Monitoring	and Cont	rolling S	votom in "	Fanka					
vi. Gas Leakage D	Dollution Monitori	water level wontonitoring		ioning 5	y 510111 111	I AIIKS					
iv Intrudor (Lum	an/Animal) Detection	ing Systelli on in Agriculture Field									
v Girl Child Safa	ty System using CD	S and CSM									
	iy bystem using OP.										

ROBOTICS LAB EXPERIMENTS.

1. Programming a simple Robot on Wheels.

2. Programming a Walking Robot.

3. Experiments based on Bipedal Robot.

4. Experiments based on Humanoid Robot

5. Spy Robot using RF Communication System

6. Study of robotic arm and its configuration

7. Study the robotic end effectors

8. Study of sensor integration.

9. Setting robot for any one industrial application after industrial visit.

Blockchain

1. Name of the Department- Computer Science & Engineering 2. Course Name Т Р Blockchain L and Distributed Ledger Technology 3. Course Code 3 0 2 4. Type of Course (use tick mark) Core (✓) **OE** () $PE(\sqrt{})$ 5. Pre-requisite (if 6. Frequency (use Even Odd Either Every anv) tick marks) $(\sqrt{})$ Sem() Sem() ()7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36Tutorials = 0Practical = 08. Course Description Blockchain technology and distributed ledgers have been hailed as a turning point in scaling information technology services at a global level. Although the digital currency Bitcoin is the bestknown Blockchain application today, the technology is set to play a much broader role in cyber security innovation. 21. LearningObjectives: 1. Understand what is a blockchain and a distributed ledger 2. Develop or extend the ability to think critically about cybersecurity 3. Understand the challenges of scaling information technology services across organizational barriers and at a global level. 4. Analyse the security of basic cryptographic primitives like hash functions and digital signatures **10.** Course Outcomes (COs): 1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work. 2. To securely interact with them. 3. Design, build, and deploy smart contracts and distributed applications. 4. Integrate ideas from blockchain technology into their own projects 11. Unit wise detailed content Unit-1 Number of Introduction to Blockchain Technology lectures = 9**Introduction to Blockchain** Blockchain concepts, evolution, structure, characteristics, a sample blockchain application, the blockchain stack, benefits and challenges, What is a Blockchain, Public Ledgers, Blocks in a Blockchain, Blockchains as public ledgers, Transactions, Distributed consensus, Building a block: Elements of Cryptography-Cryptographic Hash functions, Merkle Tree, Elements of Game Theory. Unit -2Satoshi's Bitcoin Number of lectures = 9**Blockchain Architecture and Use cases** Design methodology for blockchain applications, blockchain application templates, blockchain application development, Ethereum, Solidity, Sample use cases from Industries, Business problems. Unit – 3 Number of The Bitcoin Network and Advanced Theories lectures = 9**Decentralized applications (Dapps)** Dapps, implementing Dapps, Ethereum Dapps, case studies related to Dapps, Byzantine fault tolerance, proof-of-work vs proof-of-stake, Security and Privacy of Blockchains, smart contract vulnerabilities, Scalability of Blockchains

Blockchain and Distributed Ledger Technology

Unit – 4	Number of	Ethereum Clients
	lectures = 9	

Distributed Ledger Technology

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

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.

13. Books Recommended

Text Books

Blockchain applications: a hands-on approach, Bahga A., Madisetti V., VPT, 2017.

14. Reference Books

- 1. Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions, Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress, 2018.
- 2. Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara and Paul R. Allen, McGraw Hill, 2018.
- 3. Blockchain enabled Applications Vikram Dhillon, David Metcalf and Max Hooper, Apress, 2017,
- 4. The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology, William Mougayar, Wiley, 2016.
- 5. Blockchain Science: Distributed Ledger Technology, Roger Wattenhofer, Inverted Forest Publishing; 3rd edition, 2019.

Blockchain and Distributed Ledger Technology Lab

1. Name of the Department- Computer Science & Engineering											
2. Course Name	Blockchain and	L	Т		Р						
	Distributed										
	Ledger										
	Technology										
	Lab										
3. Course Code		3	0		2						
4. Type of Course (us	e tick mark)	Core (🗸)	PE(√)		OE ()						
5. Pre-requisite (if	Computer Basics	6. Frequency (use	Even	Odd	Either	Every					
any)		tick marks)	0	(✔)	Sem()	Sem ()					
7. Total Number of L	ectures, Tutorials,	Practical (assuming 12	weeks o	f one sen	nester)						
Lectures = 36		Tutorials = 0	Practic	al = 0							

8. Course Description

This course is designed to explore various aspects Distributed ledger technology like application in various domains.

22. LearningObjectives:

- 1. Impart strong technical understanding of Blockchain technologies
- 2. Develop familiarity of current technologies, tools, and implementation strategies
- 3. Introduce application areas, current practices, and research activity

10. Course Outcomes (COs):

The students will be able to:-

- 1. Blockchain technology landscape
- 2. Applications and implementation strategies
- 3. State-of-the-art, open research challenges, and future direction

11. List of Experiment

- 1. Create a Simple Blockchain in any suitable programming language.
- 2. Use Geth to Implement Private Ethereum Block Chain.
- 3. Build Hyperledger Fabric Client Application.
- 4. Build Hyperledger Fabric with Smart Contract.
- 5. Create Case study of Block Chain being used in illegal activities in real world.
- 6. Using Python Libraries to develop Block Chain Application.
- 7. Write a program to generate Hash key.
- 8. Using Java Libraries to develop Block Chain Applications.
- 9. Write a program to create public key in Blockchain.
- 10 Write a program to create private Key in Blockchain.

I	Design and Develop	ment of Blockchain Ap	plication	IS			
1. Name of the Depar	tment- Computer S	Science & Engineering					
2. Course Name	Design and	L	Т		Р		
	Development						
	of Blockchain						
	Applications						
3. Course Code		3	0		2		
4. Type of Course (us	e tick mark)	Core (✓)	PE(✓)		OE ()		
5. Pre-requisite (if		6. Frequency (use	Even	Odd	Either	Every	
any)		tick marks)	0	(✔)	Sem()	Sem()	
7. Total Number of L	ectures, Tutorials,	Practical (assuming 12	weeks of	one sen	nester)		
Lectures = 36		Tutorials = 0	Practica	al = 0			
8. Course Description	l						
This course provi	de the fundamental de	esign and architectural prin	nitives of I	Blockchai	n, the syst	em and	
the security aspect	ts, along with various	use cases from different ap	oplication	domains.			
23. LearningObjective	s:						
1. Understand	how blockchain sys	stems (mainly Bitcoin an	d Ethereu	ım) work	-,		
2. To securely	interact with them,						
3. Design, bui	ld, and deploy smar	t contracts and distribute	d applicat	tions,			
4. Integrate id	eas from blockchair	technology into their ov	vn project	ts.			
10 Course Outcomes							
The students w	ill he able to:						
1 Design bui	III be able to	rahain annligations					
1. Design, but							
2. To understa	and the technology t	enind blockchain					
3. To compret	hend the issues related	ed to blockchain					
4. To study the	e real-world applica	tions of blockchain					
11 Unit wise detailed	content						
Init 1	Number of						
Umt-1	$\frac{1}{10000000000000000000000000000000000$						
Blockchain Technology	icclures – 9						
Blockchain Basics F	Rlockchain Evoluti	ion Blockchain Struc	ture Bl	ockchain	Chara	otoristics	
Blockchain Application	Example: Escrow	Blockchain Stack: De	controliz	ed Com	utation I	Datform	
Etheroum Decentralize	d Storage Platform:	Swarm Decentralized 1	Messagin	a Diatfor	m Whien	ar Smort	
Contracts Decentralized	d Applications Too	ls and Interfaces	vicssagin		m- w msp	ci, Sillari	
Contracts, Decentralized	a Applications, 100	is and interfaces.					
Unit – 2	Number of						
	lectures – 9						
Domain Specific Block	hain Annlications	I					
Blockchain Application	s. Internet of Things	Medical Record Manag	pement S	vstem Fi	nTech Ir	dustrial	
and Manufacturing Do	main Name Service	and future of Blockchair	sement S	ystem, 11		luustiini	
and munufacturing, DOI		und intuite of Differentall					
Unit – 3	Number of						
0mt – 3	lectures – 9						
Blockchains for real we	rld Applications						
Monufacturing and and	and Applications	nin monogoment lasia	tion and	transmor	tation I-	tornat af	
things a voting health	oution, supply cr	iani management, logis	ues and	nanspor	iation, in	business	
mings, e-voting, nealth	care, product life cy	ycie, knowledge and inn	iovation 1	nanagem	ient, new	ousiness	
models and applications	ò						

Unit – 4	Number of	
	lectures = 9	

Blockchain Components and Applications Templates

Blockchain Application Components, Design Methodology for Blockchain Applications, Blockchain Application Templates: Many to one, Many to one for IoT applications, Many to many or Peer to Peer, One to One for Financial 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.

13. Books Recommended

Text Books

1. Blockchain Applications: A Hands-On Approach "ArshdeepBahga, Vijay Madisetti".

14. Reference Books

1. Architecture for Blockchain Applications, Xu, Xiwei, Weber, Ingo, Staples, Mark.

Design and Development of Blockchain Applications Lab

2. Course Frame Design and of Blockchain Applications 1 I I I 3. Course Code 3 0 2 4. Type of Course (use tick mark) Core (✓) PE(≺) OE () 5. Pre-requisite (if any) Computer Basics 6. Frequency (use tick marks) OM Either Even (✓) Sem() 7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36 Tutorials = 0 Practical = 0 8. Course Description This course is designed to explore various aspects of Blockchain technology like application in various domain 24. LearningObjectives: 1 To provide conceptual understanding of blockchain. To provide use cases from different applicati domains. 7. To familiarise with blockchain based solutions to innovate and improve business processes. 3. To inroduce design and architectural primitives of blockchain. 8. Course Outcomes (COS): The students will be able to:- 1. Understand blockchain technology. 2. Develop blockchain applications for on-premise and cloud based architecture. 1. Unit vise detailed content Unit-1 Number of lectures = 9 1. Install and understand Docker container, Node js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/creat	2. Course Name	Design and	T	<u>ь</u> Т		D	
Image: construct on the second sec	2. Course Name	Design and		1		P	
Applications Lab 3. Course Code 3 0 2 4. Type of Course (use tick mark) Core (*) PE(*) OE 0 5. Pre-requisite (if Computer Basics 6. Frequency (use Even Odd Either Even any) Course, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36 Tutorials = 0 Practical = 0 8. Course Description This course is designed to explore various aspects of Blockchain technology like application in various domai 24. LearningObjectives: 1 To provide conceptual understanding of blockchain technology. 7 2. To familiarise with blockchain based solutions to innovate and improve business processes. 3 To introduce design and architectural primitives of blockchain. 4. To present system and security aspects of blockchain. 5. To provide use cases from different applicati domains. 10. Course Outcomes (COs): The students will be able to:- . 1. Understand blockchain technology. 2 Develop blockchain applications for on-premise and cloud based architecture. 11. Unit wise detailed content Unit-1 Number of lectures = 9 11. Unit wise detailed content . . .		Development					
Applications J 3. Course Code 3 0 2 4. Type of Course (use tick mark) Core (\checkmark) PE(\checkmark) OE () 5. Pre-requisite (if Computer Basics 6. Frequency (use Even Odd Either Even; any) Converse Concerves, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36 Tutorials = 0 Practical = 0 8. Course Description Tutorials = 0 Practical = 0 Sem() Sem () 24. LearningObjectives: 1 To provide conceptual understanding of blockchain technology. 2. To familiarise with blockchain based solutions to innovate and improve business processes. 3. To introduce design and architectural primitives of blockchain. 4. To present system and security aspects of blockchain. 4. To present system and security aspects of blockchain. 4. To present system and security aspects of blockchain. 5. To provide use cases from different applicati domains. 10. Course Outcomes (COs): The students will be able to:- 1. Understand blockchain technology. 2. 2. Develop blockchain based solutions. 3. Write smart contract using Hyperledger Fabric and Ethereum frameworks. 4. 3. Write smart cont		of Blockchain					
Lab 3 0 2 4. Type of Course (use tick mark) Core (𝒜) PE(𝒜) OE () 5. Pre-requisite (if any) Computer Basics 6. Frequency (use tick marks) Even (𝒜) Odd Either Ever, sem 7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Sem Sem Lectures = 36 Tutorials = 0 Practical = 0 Sem 8. Course Description This course is designed to explore various aspects of Blockchain technology. 7. To familiarise with blockchain based solutions to innovate and improve business processes. 3. To introduce design and architectural primitives of blockchain. 5. To provide use cases from different applicati domains. 10. Course Outcomes (COS): The students will be able to:- 1. 1. Understand blockchain technology. 2. Develop blockchain based solutions. 3. Write smart contract using Hyperledger Fabric and Ethereum frameworks. 4. 4. Build and deploy blockchain applications for on-premise and cloud based architecture. 11. Unit wise detailed content Unit-1 Number of lectures = 9 1. Install and understand Docker container, Node, js, Java and Hyperledger Fabric, Ethereum and perform necessary soffware installation on local machine/creat instance on clou		Applications					
 A Type of Course (use tick mark) Core (✓) PE(✓) OE () Sem() Sem()<!--</th--><th>3 Course Code</th><th></th><th>3</th><th>0</th><th></th><th>2</th><th></th>	3 Course Code		3	0		2	
1. To provide concentuation Concent of the prediction pr	4. Type of Course (up	se tick mark)	$\frac{S}{Core}(\mathbf{V})$	$\mathbf{PE}(\checkmark)$		OE ()	
any Itick marks) Itick ma	5 Pre-requisite (if	Computer Basics	6 Frequency (use	Even	Odd	Either	Every
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36 Tutorials = 0 8. Course Description This course is designed to explore various aspects of Blockchain technology like application in various domai 24. LearningObjectives: 1. To provide conceptual understanding of blockchain technology. 2. To familiarise with blockchain based solutions to innovate and improve business processes. 3. To introduce design and architectural primitives of blockchain. 4. To present system and security aspects of blockchain. 5. To provide use cases from different applicati domains. 10. Course Outcomes (COs): The students will be able to:- 1. Understand blockchain technology. 2. Develop blockchain based solutions. 3. Write smart contract using Hyperledger Fabric and Ethereum frameworks. 4. Build and deploy blockchain applications for on-premise and cloud based architecture. 11. Unit wise detailed content Unit-1 Number of lectures = 9 1. Install and understand Docker container, Node, is, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run. 2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network. <	anv)	Computer Dusies	tick marks)		(\checkmark)	Sem()	Sem ()
Lectures = 36 Tutorials = 0 Practical = 0 8. Course Description This course is designed to explore various aspects of Blockchain technology like application in various domai 24. LearningObjectives: 1. To provide conceptual understanding of blockchain technology. 2. To familiarise with blockchain based solutions to innovate and improve business processes. 3. To introduce design and architectural primitives of blockchain. 4. To present system and security aspects of blockchain. 5. To provide use cases from different applicati domains. 10. Course Outcomes (COs): The students will be able to:- 1. Understand blockchain technology. 2. Develop blockchain based solutions. 3. Write smart contract using Hyperledger Fabric and Ethereum frameworks. 4. Build and deploy blockchain applications for on-premise and cloud based architecture. 11. Unit wise detailed content Unit-1 Number of lectures = 9 1. Install and understand Docker container, Node, js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run. 2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network by creating an app to test the network and its rules. 4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric to track and trace member reward	7. Total Number of I	Lectures. Tutorials.	Practical (assuming 1	2 weeks o	f one sen	nester)	20000
8. Course Description This course is designed to explore various aspects of Blockchain technology like application in various domain the construction of the conceptual understanding of blockchain technology. 2. To familiarise with blockchain based solutions to innovate and improve business processes. 3. To introduce design and architectural primitives of blockchain. 4. To present system and security aspects of blockchain. 5. To provide use cases from different applicati domains. 10. Course Outcomes (COs): The students will be able to:- 1. Understand blockchain technology. 2. Develop blockchain based solutions. 3. Write smart contract using Hyperledger Fabric and Ethereum frameworks. 4. Build and deploy blockchain applications for on-premise and cloud based architecture. 11. Unit wise detailed content Unit-1 Number of lectures = 9 1. Install and understand Docker container, Node js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run. 2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network. 3. Interact with a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network by creating an app to test the network and its rules. 4. Deelop an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric to track and trace member rewards. 6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain. Code while storing results and data in the starter plan. 7. Develop an IOT asset tracking app using Blockchain. Use an IOT asset t	Lectures $= 36$,,,	Tutorials = 0	Practic	al = 0		
24. LearningObjectives: 1. To provide conceptual understanding of blockchain technology. 2. To familiarise with blockchain based solutions to innovate and improve business processes. 3. To introduce design and architectural primitives of blockchain. 4. To present system and security aspects of blockchain. 5. To provide use cases from different applicati domains. 10. Course Outcomes (COs): The students will be able to:- 1. Understand blockchain based solutions. 3. Write smart contract using Hyperledger Fabric and Ethereum frameworks. 4. Build and deploy blockchain applications for on-premise and cloud based architecture. 11. Unit wise detailed content 10. Number of 10. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run. 2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network. 3. Interact with a blockchain network and its rules. 4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric to track and trace member rewards. 5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards. 6. Car auction network: A Hello World exampl	8. Course Description	n					
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8. Secure art using blockchain digital certificates. Node.js-based auction application can help democratize the art market.

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.

13. Books Recommended

Text Books

- Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
- Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

14. Reference Books

- 1. Iran Bashir "Mastering Blockchain", Second Edition Paperback 2018.
- 2. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
- 3. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing.

Web Resources:

https://github.com/hyperledger/https://docs.docker.com/get-started/

https://console.ng.bluemix.net/docs/services/blockchain/index.html 2.

https://developer.ibm.com/patterns/create-and-deploy-blockchainnetwork/ 3.

https://developer.ibm.com/patterns/create-and-deploy-blockchainnetwork-using-fabric-sdk-java/ 4.

https://console.bluemix.net/docs/containers/container index.html#container index 5.

http://developer.ibm.com/patterns/fitness-club-rewards-points-iotand-retail-integration/ 6.

http://developer.ibm.com/patterns/car-auction-network-hyperledgerfabric-node-sdk-starter-plan/7.

http://developer.ibm.com/patterns/devlop-an-iot-asset-tracking-appusing-blockchain/ 8.

http://developer.ibm.com/patterns/securing-art-using-blockchaindigital-certificates/

Programming Fundamentals : Golang and Solidity

1. Name of the Department- Computer Science & Engineering										
2. Course Name	Programming	L	Т		P					
	Fundamentals									
	: Golang and									
	Solidity									
3. Course Code		3	0		2					
4. Type of Course (us	e tick mark)	Core (✓)	PE (✓)		OE ()					
5. Pre-requisite (if	Computer Basics	6. Frequency (use	Even	Odd	Either	Every				
any)		tick marks)	(🗸)	0	Sem()	Sem()				
7. Total Number of L	ectures, Tutorials,	Practical (assuming 12	weeks of	f one sem	nester)					
Lectures = 36		Tutorials = 0	Practic	al = 0						

8. Course Description

Golang is next generation multi-purpose programming language that allows different users to create applications of various domains. Students will be able to learn primary fundamentals of Go and Solidity programming and potential of Go is to achieve modern computing requirements.

25. LearningObjectives:

9. Learning objectives

- 1. The objective of this course is to teach students the concepts of Statistics, probability,
- 2. probability distribution, and other statistical methods to solve various engineering problem
- 3. Master the fundamentals of writing Go and Solidity
- 4. Learn core Golangand Solidity such as variables and flow control structures.
- 5. Discover how to work with lists and sequence data.
- 6. Write Goand Solidity functions to facilitate code reuse.
- 7. V. Use Golangand Solidity to read and write files

10. Course Outcomes (COs):

- The students will be able to:-
- 1. To acquire programming skills in core Golang and Solidity.
- 2. To acquire Object Oriented Skills in Golang and Solidity.
- 3. To develop the skill of designing Graphical user Interfaces in Golang and Solidity.
- 4. To develop the ability to write database applications in Golang and Solidity.

11. Unit wise detailed content

Uni	it-1		Number	of .						
			lectures	= 9						
C	0	1	õ	7	~	1	 ъ н	** * * * *	~	

Go – Overview, Environment Setup , Program Structure , Basic Syntax , Data Types , Variables , Constants , Operators , Decision Making , Loops , Functions , Scope Rules

Uni	t – 2		Num	ber of							
			lectu	res = 9							
Ca	Chuin an	A	Daintana	Churchermon	Cline	Damaa	Mana	Desuration	True Castin a	Interfered	

Go-Strings, Arrays, Pointers, Structures, Slice, Range, Maps, Recursion, Type Casting, Interfaces, Error Handling

Unit – 3	Number of	
	lectures = 9	
Solidity - Overview, E	nvironment Setup, B	asic Syntax, First Application, Comments, Types, Variables,
Variable Scope, Opera	tors, Loops, Decis	ion Making, Strings, Arrays, Enums, Structs, Mappings,
Conversions		

, Ether Units , Special Variables , Style Guide

Unit – 4	Number of	
	lectures = 9	

Solidity – Functions, Function Modifiers, View Functions, Pure Functions, Fallback Function, Function Overloading, Mathematical Functions, Withdrawal Pattern, Restricted Access, Contracts, Inheritance, Constructors, Abstract Contracts, Interfaces, Libraries, Assembly, Events, Error Handling

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/course-category/

13. Books Recommended

Text Books

I. Go Programming Language, The (Addison-Wesley Professional Computing Series)

14. Reference Books

- I. An introduction to programming in Go : Caleb doxsey.
- II. Introducing Go: Build Reliable, Scalable Programs : Caleb Doxsey
- III. Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and blockchain

Programming Fundamentals : Golang and Solidity Lab

1. Name of the Depar	tment- Computer S	Science & Engineering				
2. Course Name	Programming	L	Т	P		
	Fundamentals					
	: Golang and					
2 Course Code	Solidity Lab	2	0			
5. Course Code	(tick mark)	$\frac{3}{Coro}(\sqrt{)}$	$\frac{\mathbf{U}}{\mathbf{DF}(\mathbf{A})}$		FΛ	
4. Type of Course (us	Computer Basics	6 Frequency (use	$\frac{\mathbf{I} \mathbf{E}(\mathbf{v})}{\mathbf{E} \mathbf{v} \mathbf{e} \mathbf{r}} = \mathbf{O} \mathbf{d}$		ither	Every
anv)	Computer Dasies	tick marks)	(\checkmark)	$(10 \ E)$	em()	Sem ()
7. Total Number of L	ectures, Tutorials,	Practical (assuming 12	weeks of on	e semest	ter)	~~~~ ()
Lectures = 36		Tutorials = 0	Practical =	0	,	
8. Course Description	1					
Student will les	arn about Solidity ar	d Golang. It is a program	nming langus	age for w	vriting	
smart contracts	which run on Ether	eum Virtual Machine on	Blockchain	uge for w	vinnig	
Sindi t Contracts			Dioenenam.			
26. LearningObjectiv	es:					
1. To aware stude	nts about computer,	its functions and utilities				
2. To promote the	e development of com	mputer-related skills for	immediate ap	oplication	n tooth	er
curricularareas.						
3. To provide a fo	undation for post-se	condaryeducation.	1 · 1 · · · ·			
4. To facilitate the	e development and a	pplication of problem-so	lving skills ii	nstudents	S.	
10. Course Outcomes	(COs):					
The students w	ill be able to:-					
1. Describe the us	age of computers ar	nd why computers are es	sential compo	onents in	i busine	ess and
society.	·	4 G 1 1'		• •	1	
2. Identify catego	ries of programs, sy	stem software and applic	ations. Organ	nize and	WORKW	/1111
3 Describe variou	is types of networks	network standards and c	ommunicatio	nsoftwa	are	
11 Unit wise detailed	content	network stundards and t	ommunicatio	5115011.00		
Unit-1	Number of					
	lectures = 9					
1. Installing GO and I	First program of He	lo World.				
2. Basic program for	implementation of I	Data types and Golang In	terface.			
3. Basic programs for	variables, constants	s, ARRAY, FOR, IF ELS	SE , SWITCH	ł.		
4. Basic programs for	Golang Slice and a	ppend function and other	functions.			
5. Basic programs on	pointers, structures,	packages, defer and sta	cking defers.			
6. Basic programs for	methods, Concurre	ncy, Goroutines and char	nnels.			
7. Programs on SELE	CT, MUTEX , ERP	OR HANDLING				
8. Basic programs on	Hello World, First	App and implementation	of Primitive	Data Tyj	pes	
9. Basic Programs on Gas Price.	Variables, Reading	and Writing to a State V	ariable, Ethe	er and W	/ei ,Gas	s and
10. Programs on If / El	lse, For and While I	Loop, Mapping, Array,	Enum, Struc	cts.		
11. Basic programs on Functions, Error,	Data Locations - St Function Modifier,	orage, Memory and Call Events , Constructor.	data , Functio	on , View	v and F	'ure
12. Basic program on I Visibility , Interfac	Inheritance , Shadov e , Payable , Sendin	ving Inherited State Vari g Ether - Transfer, Send,	ables , Callin and Call	g Parent	t Contra	acts ,

- 13. Basic programs on Fallback, Call, Delegatecall, Function Selector, Calling Other Contract.
- 14. Basic programs on Creating Contracts from a Contract , Try / Catch , , Import , Library , Hashing with Keccak256 , Verifying Signature
- 15. Applications : Multi Sig Wallet , Merkle Tree and Hacks : Re-Entrancy , Arithmetic Overflow and Underflow

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/course-category/

13. Books Recommended

Text Books

14. Reference Books

Data Analytics

Name of the Dep	oartment- Computer Scie	ence & Engineering				
2. Course	Programming for	L	Т		Р	
Name	Data Science		_		_	
1 (unit	Dutu Science					
3. Course		3	0		2	
Code						
(13470204)						
4. Type of Cour	se (use tick mark)	Core (✓)	PE(✓)		OE ()	
5. Pre-	NIL	6. Frequency (use tick	Even	Odd	Either	Every
requisite (if		marks)	()	(🗸)	Sem	Sem
any)					0	0
7. Total Number	of Lectures, Tutorials, I	Practical (assuming 12 we	eks of o	ne sem	ester)	
Lectures = 36		Tutorials $= 0$	Practic	cal = 0		
8. Course Descr	iption		•			
To provide neces	ssarv knowledge on how	to manipulate data object	ts, produ	ice gra	phics, and	alvse
data using comm	on statistical methods a	nd generate reproducible s	statistica	al repor	ts with	J
programming in	Python and R	8		1.		
9. Learning obj	ectives:					
1. Apply pri	inciples of Data Science	to the analysis of business	s proble	ms		
2. Use data	mining software to solv	e real-world problems	Proofe			
3 Employ c	utting edge tools and te	chnologies to analyze Big	Data			
10 Course Outco	omes (COs):	ennoiogies to analyze Dig	Dutu.			
1 Ability to solv	e the analytical problem	s using Python and P				
2 Develop com	e the analytical problem	ogramming language and	a numbe	or of do	taralatad	
2. Develop comp	such as Dendes Numpy	and Soiny	a numoe	51 01 u a	laielaleu	
2 Ability to com	such as Fanuas, humpy	, and Scipy	alizatio	na in D	uthon on	1 D
J. Addity to com	and manipulate data an	d produce statistical sump	alizatio	lis III F	ython and	
4. Import, export	i and manipulate data an	a produce statistical summ	laries of	contin	luous and	l
5 A bility to porf	iii F yuioii aliu K form ovnloratory data an	alveis using Dython and D	1751 0			
11 Unit wise det	ailed content	arysis using r ython and R	TISLO	,		
Unit-1	= 10					
Expressions, Ope	erators, matrices, Decisi	on Statements in python, (Control	Flow a	nd Funct	ions in
python, Classes,	Objects, Packages and I	Files in python, Tuple, Lis	ts, Sequ	ences,	Dictiona	ries,
Comprehensions						
Unit – 2	Number of lectures					
	= 9					
Numpy Arrays o	bjects, Creating Arrays.	basic operations. Indexing	g, Slicin	g and i	terating	
copying arrays. s	hape manipulation. Ider	tity array, eve function. U	niversa	l functi	on. Linea	ar
algebra with Nur	npy, eigen values and ei	igen vectors with Numpy			,	
Unit – 3	Number of lectures					
Aggregation and	I - U Joining Dandas Object	Concetenating and enner	dina da	ta fram	as index	
Aggregation and	Time series data using	nondae Handling missing	waluos	usina "	andas P	andina
and writing the d	g I mut strics uata using	, panuas manufing missing	hop Co	usilig [mhinin	anuas, R	raing
Detects Dete the	and including JSON dat	a, web scraping using pyr	to need	in stati	g and me	lycic in
Datasets Data Ira	uisiormations dasic Illa	piotito piots, common pio	is used	iii stati	silval alla	19515 111
Python.						

Unit – 4	Number of lectures = 9	
Common plots u	sed in statistical analysi	s in python Datatypes in R2. Sequence generation,
Vector and subsc	ript, Random2 number	generation in R Data frames and R functions2 Data
manipulation and	l Data Reshaping using	plyr, dplyr,2 reshape2 Parametric statistics and Non-
parametric statist	tics2 Continuous and Di	iscrete Probability distribution using R2
Correlation and c	ovariance, contingency	tables2 Overview of Sampling, different sampling
techniques2 R an	d data base connectivity	y2
Web application	development with R usi	ing Shiny2 Approaches to dealing with missing data in
R2 Exploratory c	lata analysis with simple	e visualizations using R 2 Feature or Attribute selection R2 Time series data analysis with R2
12 Brief Descrip	tion 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 ext	perts of SGT University
The link to the E	-Learning portal.	
13. Books Recon	nmended	
Text Books		
1. James Payne, "	Beginning Python: Usir	ng Python 2.6 and Python 3.1" Wrox, Ist Edition, 2010
2. Michael T. Go	odrich, Roberto Tamass	sia, Michael H. Goldwasser, "Data Structures and
Algorithms in Py	rthon", John Wiley & so	ons, 2013.
Reference Books	5	
3. Ivan Idris, "Py	thon Data Analysis", Pa	ackt Publishing Limited, 2014
4. Wes McKinne	y, "Python for Data Ana	alysis Data Wrangling with Pandas, NumPy, and
IPython", O'Reil	ly Media, Ist Edition, 20	012
5. Michael Heyd Publishing Limit	t, "Learning Pandas - Py ed. 2015.	ython Data Discovery and Analysis Made Easy", Packt
6. Jacqueline Ka	zil.Katharine Jarmul. "I	Data Wrangling with Python: Tips and Tools to
MakeYour Life I	Easier", O'Reilly Media	, Ist Edition, 2016.
7. https://docs.sc	ipy.org/doc/numpy-dev/	/reference/index.html#reference
8. <u>http://www.py</u>	thon-course.eu/numpy.p	<u>ohp</u>
9. Michael J. Cra	wley, "The R Book", W	Viley, 2nd Edition, 2012.
10. Robert Kabao	coff, "R in Action", Mar	nning Publication, Ist Edition, 2011.
11. TorstenHothe	orn, Brian S. Everitt, "A	Handbook of Statistical Analyses Using R", Chapman
and Hall_CRC, 2	2nd Edition, 2009.	
12. Chris Beeley	"Web Application Deve	elopment with R Using Shiny", Pact Publishing, 2013.
13. Phil Spector,	"Data Manipulation wit	th R", Springer, 2008.
14. Prabhanjan N	I. Tattar, Suresh Ramaia	ah, B. G. Manjunath, "A Course in Statistics with R",
wiley, 2016	- "Dete Mining Al	there Euclaired Using D? with 2014
15. PawelCichos	z, Data Mining Algorit	tinms: Explained Using K", wiley, 2014
 12. Chris Beeley 13. Phil Spector, 14. Prabhanjan N wiley, 2016 15. PawelCichos 	web Application Deve "Data Manipulation wit I. Tattar, Suresh Ramaia z, "Data Mining Algorit	th R", Springer, 2008. ah, B. G. Manjunath, " A Course in Statistics with R", thms: Explained Using R", wiley, 2014

Programming for Data Science Lab 1. Name of the Department- Computer Science & Engineering **Programming** Т Р 2. L **Course** for Data Science Name Lab 3. 3 0 2 Course Code 4. Type of Course (use tick Core (\checkmark) $\overline{PE(\checkmark)}$ **OE** () mark) Odd 5. Pre-Programming Even Either Every 6. Frequency (use **(**√) Sem() Sem() requisi tick marks) ()te (if any) 7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 0Tutorials = 0 **Practical = 10** 8. Course Description This course introduces you to the basics of the R language such as data types, techniques for manipulation, and how to implement fundamental programming tasks. 27. Learning Objectives: 1. Manipulate numeric and textual data types using the R programming language 2. Manipulate numeric and textual data types using the R programming language 3. Define and manipulate R data structures, including vectors, factors, lists, and data frames **10.** Course Outcomes (COs): The students will be able to:-1. Understand the basics in R programming in terms of constructs, control statements, string functions 2. Understand the use of R for Big Data analytics 3. Learn to apply R programming for Text processing 4. Able to appreciate and apply the R programming from a statistical perspective **11. Lab Experiments** Sr.No Topics Creating and displaying Data. 1 2 Matrix manipulations 3 Creating and manipulating a List and an Array Creating a Data Frame and Matrix-like Operations on a Data Frame 4 5 Merging two Data Frames 6 Applying functions to Data Frames 7 Using Functions with Factors 8 Accessing the Internet 9 String Manipulations 10 Visualization Effects 11 Plotting with Layers Overriding

12

13 14

15

Overriding Aesthetics

Histograms and Density Charts

Simple Linear Regression – Fitting, Evaluation and Visualization

Multiple Linear Regression, Lasso and Ridge Regression

Big Data Technologies

2. Course NameBig Data TechnologiesLTP3. Course Code3024. Type of Course (use tick mark)Core (\checkmark)PE(\checkmark)OE ()5. Pre- requisite (if any)NIL6. Frequency (use tick marks)Eve n (()Od (\checkmark)Eithe r Sem ()7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Sem ()Sem ()7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Sem ()8. Course DescriptionTutorials = 0Practical = 09. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr.10. Course Outcomes (COS): 1.1.Illustrate the usage of data on different Big data ecosystems. 2.Demonstrate the Pig architecture and evaluation of pig scripts. 3.Describe the Hive architecture and evaluation of pig scripts. 5.Understand the concepts of indexing and use these concepts in solr search engine. 6.Understand the concepts of indexing and use these concepts in solr search engine.	Name of the De	partment- Computer S	cience & Engineering				
NameTechnologiesImage: second	2. Course	Big Data	L	Т		Р	
3. Course Code3024. Type of Course (use tick mark)Core (\checkmark)PE(\checkmark)OE ()5. Pre- requisite (if any)NIL6. Frequency (use tick marks)Eve n ((\checkmark)Od dEithe Frequency (\checkmark)Ever y Sem ()7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Sem ()Icetures = 36Tutorials = 0Practical = 08. Course DescriptionProvides an overview of machine learning techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.9. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr.10. Course Outcomes (COS):1.1Illustrate the usage of data on different Big data ecosystems. 2.Demonstrate the Pig architecture and evaluation of pig scripts. 3.Describe the Hive architecture and execute SQL queries on sample data sets. 4. Understand the process of transferring data between different file systems and to execute operations using sqoop.1Illustrate the usage of indexing and use these concepts in solr search engine. 6. Understand the concepts of indexing and use these concepts using scipe.3Describe the Hive architecture and execute SQL queries on sample data sets. 4. Understand the concepts of indexing and	Name	Technologies					
3. Course Code3024. Type of Course (use tick mark)Core (\checkmark)PE(\checkmark)OE ()5. Pre- requisite (if any)NIL6. Frequency (use tick marks)Eve n (d)OdEithe Ever y (\checkmark)7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Sem ()Lectures = 36Tutorials = 0Practical = 08. Course DescriptionProvides an overview of machine learning techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.9. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr.10. Course Outcomes (COS):1.1.1llustrate the usage of data on different Big data ecosystems. 2.Demonstrate the Pig architecture and execute SQL queries on sample data sets. 4. Understand the process of transferring data between different file systems and to execute operations using sqoop.1.Understand the process of transferring data between different file systems and to execute operations using sqoop.2.Understand the concepts of indexing and use these concepts in solr search engine.4. Understand the concepts of indexing and use these concepts in solr search engine. <td></td> <td>0</td> <td></td> <td></td> <td></td> <td></td> <td></td>		0					
3. Course Code3024. Type of Course (use tick mark)Core (\checkmark)PE(\checkmark)OE ()5. Pre- requisite (if any)NIL6. Frequency (use tick marks)Eve n (dOd r Sem (\checkmark)Eithe y Sem ()7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Sem ()1. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Lectures = 36Tutorials = 08. Course DescriptionProvides an overview of machine learning techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.9. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr.10. Course Outcomes (COS):1.1.Illustrate the usage of data on different Big data ecosystems. 3.Describe the Hive architecture and evaluation of pig scripts. 3.Describe the Hive architecture and evaluation of pig scripts. 3.Describe the Hive architecture and execute SQL queries on sample data sets. 4.Understand the process of transferring data between different file systems and to execute operations using sqoop.1.Understand the process of transferring data between different file systems and to execute operations using sqoop.3.Understand the process of transferring data betwe	2.0		2	0		•	
4. Type of Course (use tick mark)Core (\checkmark)PE(\checkmark)OE ()5. Pre- requisite (if any)NIL6. Frequency (use tick marks)Eve n (dOd r Sem ()Eithe y Sem ()7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Sem ()Lectures = 36Tutorials = 0Practical = 08. Course DescriptionFractical (assuming techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.9. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr.10. Course Outcomes (COS): 1.Illustrate the usage of data on different Big data ecosystems. 2.Demonstrate the Pig architecture and evaluation of pig scripts. 3.Describe the Hive architecture and evaluation of pig scripts. 3.Describe the Hive architecture and evaluation of pig scripts. 3.Describe the Hive architecture and execute SQL queries on sample data sets. 4.Understand the process of transferring data between different file systems and to execute operations using sqoop.5.Understand the process of transferring data between different file systems and to execute operations using sqoop.6.Understand the concepts of indexing and use these concepts in solr search engine. 6.Understand the concepts of indexing and use these concepts in solr search engine.	3. Course		3	U		2	
A. Type of Course (use tick mark)Core (V)TE(V)OE ()5. Pre- requisite (if any)NIL6. Frequency (use tick marks)Eve n (dOdEithe Ever yany)0Image: Core (V)0Sem ($)$ 7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Lectures = 36Tutorials = 0Practical = 08. Course DescriptionProvides an overview of machine learning techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.9. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr.10. Course Outcomes (COs):1.1.Illustrate the usage of data on different Big data ecosystems.2.Demonstrate the Pig architecture and evaluation of pig scripts.3.Describe the Hive architecture and execute SQL queries on sample data sets.4.Understand the process of transferring data between different file systems and to execute operations using sqoop.5.Understand the concepts of indexing and use these concepts in solr search engine.6.Implement and evaluate the data manipulation procedures using nig hive, scoop and colr	Lode	so (uso tiol mort)	Coro (11)		<u> </u>	ΟΕΟ	
S. Fre- requisite (if any)NL6. Frequency (use tick marks)EveOd n (dEntre reguiseEver reguise7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)0Sem ()7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)Sem ()Lectures = 36Tutorials = 0Practical = 08. Course DescriptionProvides an overview of machine learning techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.9. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr.10. Course Outcomes (COs):1.Illustrate the usage of data on different Big data ecosystems. 2.Demonstrate the Pig architecture and evaluation of pig scripts.3.Describe the Hive architecture and execute SQL queries on sample data sets.4.Understand the process of transferring data between different file systems and to execute operations using sqoop.5.Understand the concepts of indexing and use these concepts in solr search engine.6.Implement and evaluate the data manipulation procedures using right bias.	4. Type of Cour	se (use lick mark))		Even
Indication	5. Fre-	INIL	o. Frequency (use tick	Eve	Uu d	Eithe n Som	Ever
7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36 Tutorials = 0 8. Course Description Provides an overview of machine learning techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems. 9. Learning objectives: To have knowledge on accessing, storing and manipulating the huge data from different resources. Working environment of Pig and Hive for processing the structured and unstructured data and differentiate the RDBMS and Hive architectures and implement queries to process the data using sqoop. 4. To have a knowledge on searching mechanisms using solr. 10. Course Outcomes (COs): 11.Illustrate the usage of data on different Big data ecosystems. 2.Demonstrate the Pig architecture and evaluation of pig scripts. 3.Describe the Hive architecture and execute SQL queries on sample data sets. 4.Understand the process of transferring data between different file systems and to execute operations using sqoop. 5.Understand the concepts of indexing and use these concepts in solr search engine. 6.Implement and evaluate the data manipulation procedures using pig. bive scoop and solr	requisite (ii		marks)	ш ()	u (v/)	r Sem	y Som
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7 Develop an application using different eco system tools by taking standard sample data set	7 Develop an apr	lication using different	eco system tools by taking	y standa	rd sam	ple data s	et
11. Unit wise detailed content	11. Unit wise det	ailed content		Stundu	u buili	pie aata s	
Unit-1 Number of lectures	Unit.1	Number of lectures					
= 10		= 10					
Big data- Concepts Needs and Challenges of hig data. Types and source of hig data	Big data- Concer	ts Needs and Challeng	es of big data Types and	source o	f hig d	ata	
Components of Hadoon Eco System- Data Access and storage. Data Intelligence. Data	Components of H	Hadoon Eco System- Da	ta Access and storage. Da	ta Intelli	igence.	Data	
Integration, Data Serialization, Monitoring, Indexing, Introduction, Parallel processing using Pig.	Integration. Data	Serialization. Monitori	ng. Indexing. Introduction	. Paralle	l proce	essing usi	ng Pig.
Pig Architecture, Grunt, Pig Data Model-scalar and complex types. Pig Latin- Input and output.	Pig Architecture.	Grunt. Pig Data Model	-scalar and complex types	. Pig La	tin- In	out and o	utput.
Relational operators, User defined functions. Working with scripts.	Relational operat	tors, User defined function	ons. Working with scripts		. 1		· · · · · ·
Unit – 2 Number of lectures	Unit – 2	Number of lectures					
= 9		= 9					
Introduction-Hive modules, Data types and file formats, Hive OL-Data Definition and Data	Introduction-Hiv	e modules. Data types a	nd file formats, Hive OL-	Data De	finitio	n and Dat	a
Manipulation. Hive OL queries, Hive OL views- reduce query complexity. Hive scripts. Hive	Manipulation. H	ive OL queries, Hive Ol	views- reduce query con	plexity.	Hive	scripts. H	live
QL Indexes-create, show, drop. Aggregate functions. Bucketing vs Partitioning	OL Indexes-crea	te, show, drop. Aggrega	te functions. Bucketing vs	Partitio	ning	1	
Unit – 3 Number of lectures = 8	Unit – 3	Number of lectures = 8			U		
Relational database management in Hadoon. Bi directional data transfer between Hadoon and	Relational databa	se management in Had	on. Bi directional data tra	insfer be	tween	Hadoon	and
external database. Import data- Transfer an entire table import subset data use different file	external database	. Import data- Transfer	an entire table import sub	set data	use d	ifferent fi	le
format. Incremental import import new data incrementally import data preserving the value	format Incremen	tal import import new o	lata, incrementally import	data pr	eservir	g the val	ue.
Export transfer data from Hadoop, update the data, update at the same time, export subset of	Export transfer d	ata from Hadoon. undat	e the data. update at the sa	me time	e, expo	rt subset	of

columns. Hadoop ecosystem integration- import data to hive, using partitioned hive tables, replace special delimiters.

Unit – 4 Number of lectures = 9

Introduction. Information retrieval search engine, categories of data, inverted index. Designfield attributes and types. Indexing- indexing tool. Indexing operations using csv documents. Searching data- parameters, default query, Recent Trends in Big data

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.

13. Books Recommended

Text Books

1.AlanGates,Programming PigDataflowScriptingwithHadoop,O'ReillyMedia,Inc,2011. 2.Jason Rutherglen, Dean Wampler, Edward Caprialo, Programming Hive, O'ReillyMedia Inc,2012

3.KathleenTing,JarekJarcecCecho,ApacheSqoopCookbook,O'ReillyMediaInc,2013.

Reference Books

4.Dikshant Shahi, Apache Solr: A Practical approach to enterprise search, Apress, 2015. 5.Chuck Lam, Hadoop in Action, Manning Publications, 2010.

6.Andrea Gazzarini, Apache Solr Essentials, PACKT Publications, 2015.

4 17		Big Data Technologies Lab				1
1. Name	e of the Department-	Computer Science & Engineerin	g			
2.	Big Data	L	Т		P	
Course	Technologies					
Name	Lab					
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J. Course		3	U		2	
Code						
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a. Type mark)	of Course (use lick	Core (V)	PE(*)		OE ()	
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te (if						
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7. Total	Number of Lectures	, Tutorials, Practical (assuming)	12 weeks of 12	of one sen	nester)	
Lecture	s = 0	Tutorials = 0	Practic	cal = 10		
8. Cour	se Description		1 1	1		
T	his course will introduce	the students to practical aspects of ar	alytics at la	rge scale,	1.e., big da	ita. The
	ourse will start with a ba	sic introduction to big data concepts s	panning nai	dware, sy	stems and	sontware,
al		nowing topics.				
28. Lea	rning Objectives:					
1. To	o understand setting up of	of Hadoop Cluster				
2. T	o solve problems using	Map Reduce Technique				
3. To	o solve Big Data problei	ns				
10. Cou	rse Outcomes (COs)	:				
The stuc	lents will be able to:-					
1. Se	et up multi-node Hadoop	o Clusters				
2. A	pply Map Reduce algori	thms for various algorithms				
3. D	esign new algorithms th	at uses Map Reduce to apply on Unstr	uctured and	l structure	d data	
11. Lab	Experiments					
Sr.No	Topics					
						CO
1	Set up a pseudo-dist	ributed, single-node Hadoop cluster ba	acked by the	e Hadoop		
	Distributed File Syst	em, running on Ubuntu Linux. After s	successful in	nstallation	on	1
	one node, configurat	ion of a multi-node Hadoop cluster(or	ne master ar	nd multiple	e	
	slaves).					
2	MapReduce applicat	ion for word counting on Hadoop clus	ter			
3	Unstructured data in	to NoSQL data and do all operations s	such as NoS	QL query	with	2
4	K-means clustering	using map reduce				-
5	Page Rank Computa	tion				
6	Mahout machine lea	rning library to facilitate the knowledge	ze build up	in big data	1	
	analysis.		P	- 8		2,3
7	Application of Reco	mmendation Systems using Hadoop/m	ahout libra	ries		

Name Mining Massive Data L T P 3. Course O 2 2 Gode 3 0 2 4. Type of Course (use tick mark) Core (\checkmark) PE(\checkmark) OE () 5. Pre- requisite (if NL 6. Frequency (use tick marks) Even Odd Either Every (\checkmark) OB () 7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36 Tutorials = 0 Practical = -0 8. Course Description Totorials = 0 Practical = -0 Practical = -0 Practical = -0 9. Learning objectives: 1. To provide comprehensive knowledge on developing and applying machine learning algorithms for massive real-world datasets in distributed frameworks. . . 9. Learning objectives: 1. To provide comprehensive knowledge on Deep Learning of Mahout . . 10. Course Outcomes (COs): 1. Identify right machine learning / mining algorithm for handling massive data . . 1. 2. Apply classification and regression models with Spark and Mahout . . . 1. Unit wise detailed content . . .			Mining Massive Data				
2. Course Name Mining Massive Data L T P 3. Course 3 0 2 3. Course 3 0 2 Code 3 0 2 4. Type of Course (use tick mark) Core (\checkmark) PE(\checkmark) OE () 5. Pre-requisite (if marks) 6. Frequency (use tick marks) Even (\checkmark) Od E fither Every Sem $()$ any) 7. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester) Lectures = 36 Tutorials = 0 Practical = 0 8. Course Description Provides an overview of data mining and machine learning algorithms for analyzing very large amounts of data. The emphasis is on Map Reduce as a tool for creating parallel algorithms that can process very large amounts of data. 9. Learning objectives: 1. To provide comprehensive knowledge on developing and applying machine learning algorithms for massive real-world datasets in distributed frameworks. 2. To demonstrate the use of big data analytics tools like Spark and Mahout for mining massive datasets. 1. To provide comprehensive knowledge on Deep Learning and Extreme Learning concepts. 10. Course Outcomes (COs): 1. Jateptity machine learning for clustering and classification 3. Gue be planting to solve real-life problem 1. J.Apply classification and regression models with Spark and Mahout 3. So impart in depth knowledge on clustering	Name of the Dep	partment- Computer S	cience & Engineering				
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Properties of Graphs

Semi-Supervised Learning: Module content: Introduction to Semi-Supervised Learning, Semi-Supervised Clustering, Transductive Support Vector Machines

Unit – 4 Number of lectures = 9

Deep Learning:

Module content: Introduction, Deep Neural Networks, Deep Belief Networks, Auto Encoders, Recurrent Networks

Extreme Learning:

Extreme Learning Machines (ELM), ELM auto encoder, Extreme Support Vector Regression

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.

13. Books Recommended

Text Books

1. Jure Leskovec, AnandRajaraman, Je_ Ullman, "Mining of Massive Datasets", Standford Press, 2011.

2. Nick Pentreath, "Machine Learning with Spark", Packt Publishing,

3. Olivier Chapelle, Bernhard Scholkopf, Alexander Zien "Semi-Supervised Learning", The MIT Press,2006.

Reference Books

1. Ron Bekkerman, Mikhail Bilenko, John Langford "Scaling Up Machine Learning: Parallel and Distributed Approaches", Cambridge University Press, 2012.

2. Jimmy Lin, Chris Dyer, "Data-Intensive Text Processing with MapReduce", Morgan Claypool Publishers, 2010.

3. Hennessy, J.L. and Patterson, D.A., 2011. Computer architecture: a quantitative approach. Elsevier.

4. ChandramaniTiwary "Learning Apache Mahout", Packt Publishing, 2015.

5. Fuchen Sun, Kar-Ann Toh, Manuel Grana Romay, KezhiMao, "Extreme Learning

Machines2013: Algorithms and Applications", Springer, 2014.

Mining Massive Data Lab

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from large amounts of data. Data mining can also be referred as knowledge mining from data, knowledge extraction, data archeology and data dredging.
knowledge extraction, data archeology and data dredging.
29 Learning Objectives:
1. To familiarize students with the basic concepts of Data mining and Warehousing
2. To explain and demonstrate various mining algorithms on real world data.
3. To brief students about the future trends in the fields of data mining.
10 Course Outcomes (COs):
The students will be able to:
1 Describe various preprocessing techniques and statistical techniques and apply those techniques on
the given data set
2. Apply various association rule mining algorithms on the given data set
3. Apply various classification algorithms on the given data set.
11. Lab Experiments
Sr.No Topics
СО
1 Demonstration of preprocessing on .arff file using student data .arff
2 To perform the statistical analysis of data
3 Demonstration of association rule mining using apriory algorithm on supermarket
data.
4 Demonstration of FP Growth algorithm on supermarket data
5 To perform the classification by decision tree induction using weka tools.
6 To perform classification using Bayesian classification algorithm using R.
7 To perform the cluster analysis by k-means method using R.
8 To perform the hierarchical clustering using R programming.
9 Study of Regression Analysis using R programming.
10 10. Outlier detection using R programming