AL-AMEEN ENGINEERING COLLEGE

(AUTONOMOUS)

Accredited by NAAC with "A" Grade :: An ISO Certified Institution
(Affiliated to Anna University, Chennai & Approved by AICTE, New Delhi)
Karundevanpalayam, NanjaiUthukkuli Post, Erode – 638 104, Tamilnadu, INDIA.

CURRICULUM & SYLLABI

SEMESTERS – I to VIII

(Regulations 2020)

CHOICE BASED CREDIT SYSTEM

B.E. Computer Science and Engineering

Applicable to the Students admitted in the AY 2020-21 only

KNOWLEDGE LEVELS (BLOOM'S TAXONOMY)

Notation	Knowledge Levels
K1	Remembering
K2	Understanding
K3	Applying
K4	Analysing
K5	Evaluating
K6	Creating

VISION	
	To be a renowned programme for satisfying the rapidly changing information and communication technology needs of the rural and underprivileged with humane values.

MISSION	
	To grow comprehensive ICT experiences in students for uplifting rural and the under-privileged community. To impart Computer Science education towards inclusiveness of trans-disciplinary areas in the ever-changing ICT environment. To develop students focused on careers and entrepreneurship with awareness of social, economic and ethical impacts.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Graduates will be prepared with an ethical work culture for taking ICT to the rural and the under-privileged.
PEO 2	Graduates will be employed in the computing profession, and will understand, research, apply new ideas and technologies of ICT as the field evolves.
PEO 3	Graduates will be equipped with communication skills and leadership qualities, with an interest in, and aptitude for starting-up and growing their own new firms.
PEO 4	Graduates will demonstrate their ability to work effectively as a team member in an ever-changing professional environment.

PROGRAM OUTCOMES (POs)	
PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these

	to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO 1	Organize heterogeneous data for accurate large-scale data processing using appropriate algorithms and tools.
PSO 2	Understand modern networking technologies and apply programming skills to create scalable real-time applications.

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA1T1	Engineering Mathematics I	BS	50	50	3	1	0	4
2	20CY1T2	Engineering Chemistry	BS	50	50	3	0	0	3
3	20EN1T3	Communicative English I	HS	50	50	3	1	0	4
4	20PH1T4	Engineering Physics	BS	50	50	3	0	0	3
5	20CS1T5	Fundamental of Computing and Programming	ES	50	50	3	0	0	3
LABORATORY COURSES									
6	20GE1L1	Physics and Chemistry Laboratory	BS	50	50	0	0	3	1.5
7	20CS1L2	Computer Practices Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
8		Universal Human Values 1 - Induction Programme	MC	-	-	-	-	-	-
Total						**15**	**2**	**6**	**20**

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA2T1	Engineering Mathematics II	BS	50	50	3	1	0	4
2	20EN2T3	Communicative English II	HS	50	50	3	0	0	3
3	20EE2T4	Basics of Electrical Engineering	ES	50	50	3	0	0	3
4	20CSCT5	Python Programming	ES	50	50	3	0	0	3
LABORATORY COURSES									
5	20EM2L1	Engineering Practices Laboratory	ES	50	50	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	ES	50	50	0	0	3	1.5
7	20CS2L3	Python Programming Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
8	20CY2T2	Environmental Sciences	MC	100	-	3	0	0	0
Total						**15**	**1**	**9**	**17.5**

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA3T1	Probability and Queuing Theory	BS	50	50	3	1	0	4
2	20CS3T2	Data Structures & Algorithms	PC	50	50	3	1	0	4
3	20EC3T3	Digital Principles and System Design	ES	50	50	3	0	0	3
4	20CS3T4	Computer Architecture	PC	50	50	3	0	0	3
5	20CS3T5	Object Oriented Programming with Java	PC	50	50	3	0	0	3
LABORATORY COURSES									
6	20CS3L1	Data Structures Laboratory	PC	50	50	0	0	3	1.5
7	20CS3L2	Object Oriented Programming with Java Laboratory	PC	50	50	0	0	3	1.5
8	20EC3L3	Digital Systems Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
9	20MCCT1	Constitution of India	MC	100	-	3	0	0	0
Total						**18**	**2**	**9**	**21.5**

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20EC4T1	Microprocessor and Microcontroller	ES	50	50	3	0	0	3
2	20CS4T2	User Interface Design	PC	50	50	3	1	0	4
3	20CS4T3	Database Management Systems	PC	50	50	3	0	0	3
4	20CS4T4	Operating Systems	PC	50	50	3	1	0	4
5		Open Elective - I	OE	50	50	3	0	0	3
LABORATORY COURSES									
6	20ENCL1	Communication Skills Laboratory	HS	50	50	0	0	2	1
7	20CS4L2	Database Management Systems Laboratory	PC	50	50	0	0	3	1.5
8	20CS4L3	Operating Systems Laboratory	PC	50	50	0	0	3	1.5
MANDATORY COURSE									
9	20HSCT1	Universal Human Values 2: Understanding Harmony	HS	100	-	2	1	0	3
Total						**17**	**3**	**8**	**24**

SEMESTER V

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1		Professional Elective - I	PE	50	50	3	0	0	3
2		Open Elective – II	OE	50	50	3	0	0	3
3	20HSCT2	Professional Ethics	HS	50	50	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
4	20CS5LT1	Computer Network	PC	50	50	2	0	4	4
5	20CS5LT2	Internet of Things	PC	50	50	2	0	4	4
6	20CS5LT3	Web Technology	PC	50	50	2	0	4	4
EMPLOYABILITY ENHANCEMENT COURSE									
7	20PT5T1	Career Guidance - I	EEC	100	--	2	1	0	0
Total						**17**	**1**	**12**	**21**

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS6T1	Block chain Technology	PC	50	50	3	1	0	4
2	20CS6T2	Software Engineering	PC	50	50	3	0	0	3
3		Professional Elective - II	PE	50	50	3	0	0	3
4		Professional Elective - III	PE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
5	20CS6LT1	Compiler Design	PC	50	50	2	0	4	4
6	20CS6LT2	Object Oriented Analysis & Design	PC	50	50	2	0	4	4
EMPLOYABILITY ENHANCEMENT COURSE									
7	20PT6T1	Career Guidance - II	MC	100	--	2	1	0	0
Total						**18**	**2**	**8**	**21**

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1		Professional Elective - IV	PE	50	50	3	0	0	3
2		Professional Elective - V	PE	50	50	3	0	0	3
3		Open Elective – III	OE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
4	20CS7LT1	Cryptography & Network Security	PC	50	50	3	0	2	4
5	20CS7LT2	Cloud Computing	PC	50	50	2	0	4	4
6	20CS7LT3	Artificial Intelligence and Machine Learning	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	100	-	0	0	6	3
Total						**16**	**0**	**16**	**24**

SEMESTER VIII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
LABORATORY COURSES									
1	20CS8L1	Project Work	EEC	50	50	0	0	20	10
2	20CS8L2	Industrial Training / Internship	EEC	100	-	4 Weeks			3
Total						**0**	**0**	**20**	**13**

Total Credits: 162

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

S. No.	Course Code	Course Title	L	T	P	C
1	20EN1T3	Communicative English I	3	1	0	4
2	20EN2T3	Communicative English II	3	0	0	3
3	20ENCL1	Communication Skills Laboratory	0	0	2	1
4	20HSCT1	Universal Human Values 2: Understanding Harmony	2	1	0	3
5	20HSCT2	Professional Ethics	3	0	0	3

BASIC SCIENCES (BS)

Sl.No.	Course Code	Course Title	L	T	P	C
1	20MA1T1	Engineering Mathematics – I	3	1	0	4
2	20CY1T2	Engineering Chemistry	3	0	0	3
3	20PH1T4	Engineering Physics	3	0	0	3
4	20GE1L1	Physics and Chemistry Laboratory	0	0	3	1.5
5	20MA2T1	Engineering Mathematics – II	3	1	0	4
6	20MA3T1	Probability and Queuing Theory	3	1	0	4

ENGINEERING SCIENCES (ES)

Sl.No.	Course Code	Course Title	L	T	P	C
1	20CS1T5	Fundamentals of Computing and Programming	3	0	0	3
2	20CS1L2	Computer Practices Laboratory	0	0	3	1.5
3	20EE2T4	Basics of Electrical Engineering	3	0	0	3
4	20CSCT5	Python Programming	3	0	0	3
5	20EM2L1	Engineering Practices Laboratory	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	0	0	3	1.5

7	20CS2L3	Python Programming Laboratory	0	0	3	1.5
8	20EC3T3	Digital Principles & System Design	3	0	0	3
9	20EC3L3	Digital System Laboratory	0	0	3	1.5
10	20EC4T1	Microprocessor and Microcontroller	3	0	0	3

PROFESSIONAL CORE (PC)

Sl.No.	Course Code	Course Title	L	T	P	C
1	20CS3T2	Data Structures & Algorithms	3	1	0	4
2	20CS3T4	Computer Architecture	3	0	0	3
3	20CS3T5	Object Oriented Programming with Java	3	0	0	3
4	20CS3L1	Data Structures Laboratory	0	0	3	1.5
5	20CS3L2	Object Oriented Programming with Java Laboratory	0	0	3	1.5
6	20CS4T2	User Interface Design	3	1	0	4
7	20CS4T3	Database Management Systems	3	0	0	3
8	20CS4T4	Operating Systems	3	1	0	4
9	20CS4L2	Database Management Systems Laboratory	0	0	3	1.5
10	20CS4L3	Operating Systems Laboratory	0	0	3	1.5
11	20CS5LT1	Computer Network	2	0	4	4
12	20CS5LT2	Internet of Things	2	0	4	4
13	20CS5LT3	Web Technology	2	0	4	4
14	20CS6T1	Block chain Technology	3	1	0	4
15	20CS6T2	Software Engineering	3	0	0	3
16	20CS6LT1	Compiler Design	2	0	4	4
17	20CS6LT2	Object Oriented Analysis & Design	2	0	4	4

18	20CS7LT1	Cryptography & Network Security	3	0	2	4
19	20CS7LT2	Cloud Computing	2	0	4	4
20	20CS7LT3	Artificial Intelligence and Machine Learning	2	0	4	4

PROFESSIONAL ELECTIVES (PE)

Semester – V (Elective I)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20CS5E1	Basics of Data Science	3	0	0	3
2	20CS5E2	Information Security	3	0	0	3
3	20CS5E3	Social Network Analysis	3	0	0	3
4	20CS5E4	Advanced Operating Systems	3	0	0	3

Semester – VI (Elective II)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20CS6E1	Data ware Housing And Data Mining	3	0	0	3
2	20CS6E2	Ethical Hacking and Network Defence	3	0	0	3
3	20CS6E3	Knowledge Management	3	0	0	3
4	20CS6E4	Real Time Systems	3	0	0	3

Semester – VI (Elective III)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20CS6E5	Data Handling and Visualization	3	0	0	3
2	20CS6E6	Cyber Crime and Cyber Forensics	3	0	0	3
3	20CS6E7	Software Project Management	3	0	0	3
4	20CS6E8	Software Testing	3	0	0	3

Semester – VII (Elective IV)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20IT6T1	Big Data Analytics	3	0	0	3
2	20ECCE2	Wireless Ad hoc and Sensor Networks	3	0	0	3
3	20CS7E3	Theory of Computation	3	0	0	3
4	20CS7E4	Mobile Computing	3	0	0	3

Semester – VII (Elective V)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20CS7E5	Deep Learning	3	0	0	3
2	20CS7E6	Crypto Currency	3	0	0	3
3	20CS7E7	Distributed Systems	3	0	0	3
4	20CS7E8	NPTEL Courses	3	0	0	3

OPEN ELECTIVES (OE)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20CSO01	Object Oriented Programming Using Java	3	0	0	3
2.	20CSO02	Computer Architecture	3	0	0	3
3.	20CSO03	Data Structures	3	0	0	3
4.	20CSO04	Operating Systems	3	0	0	3
5	20CSCT5	Python Programming	3	0	0	3
6	20CSO06	Cloud Computing	3	0	0	3
7	20CSO07	Artificial Intelligence	3	0	0	3
8	20IT6T1	Big Data Analytics	3	0	0	3
9	20CSO09	Internet of Things	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Course Code	Course Title	L	T	P	C
1	20PT5T1	Career Guidance - I	2	1	0	0
2	20PT6T1	Career Guidance - II	2	1	0	0
3	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3
4	20CS8L1	Project Work	0	0	20	10
5	20CS8L2	Industrial Training / Internship	4 Weeks			3

MANDATORY COURSES (MC)

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Universal Human Values 1 - Induction Programme	0	0	0	0
2.	20CY2T2	Environmental Sciences	3	0	0	0
3.	20MCCT1	Constitution of India	3	0	0	0

VALUE ADDED COURSES (VAC)

Sl. No.	Course Code	Course Title	Credit
1.	20CSV01	J2EE	
2.	20CSV02	Php, Mysql	
3.	20CSV03	Android Application Development	
4.	20CSV04	3d Studio Max, Maya	
5.	20CSV05	Hardware And Network Trouble Shooting	
6.	20CSV06	Ethical Hacking	
7.	20CSV07	Block Chain Technology	

CURRICULUM BREAKDOWN STRUCTURE

Subject	AICTE suggested breakdown of credits	Total number of credits	Curriculum Content (% of total number of credits of the program)
Humanities and Social Sciences including Management (HS)	**12**	**14**	**8.6**
Basic Sciences (BS)	**24**	**19.5**	**12**
Engineering Sciences (ES)	**29**	**22.5**	**13.8**
Professional Core (PC)	**49**	**66**	**40.7**
Program Electives (PE)	**18**	**15**	**9.2**
Open Electives (OE)	**12**	**9**	**5.5**
Employability Enhancement Courses (EEC) – Practical Courses and Project Work	**15**	**16**	**9.8**
Mandatory Courses (MC)	**0**	**0**	**0**
Total	**159**	**162**	**100.00**

CREDIT SUMMARY

Sl. No.	Subject Area	Credits per Semester								Total Credits	AICTE Suggested Credits
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	4	3		4	3				**14**	12
2	**BS**	11.5	4	4						**19.5**	24
3	**ES**	4.5	10.5	4.5	3					**22.5**	29
4	**PC**			13	14	12	15	12		**66**	49
5	**PE**					3	6	6		**15**	18
6	**OE**				3	3		3		**9**	12
7	**EEC**					-	-	3	13	**16**	15
8	**MC**		-	-					-	-	-
TOTAL		**20**	**17.5**	**21.5**	**24**	**21**	**21**	**24**	**13**	**162**	**159**

HS – Humanities and Social Sciences including Management
BS – Basic Sciences
ES – Engineering Sciences
PC – Professional Core
PE – Professional Electives
OE – Open Electives
EEC – Employability Enhancement Courses
MC – Mandatory Courses

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA1T1	Engineering Mathematics I	BS	50	50	3	1	0	4
2	20CY1T2	Engineering Chemistry	BS	50	50	3	0	0	3
3	20EN1T3	Communicative English I	HS	50	50	3	1	0	4
4	20PH1T4	Engineering Physics	BS	50	50	3	0	0	3
5	20CS1T5	Fundamental of Computing and Programming	ES	50	50	3	0	0	3
LABORATORY COURSES									
6	20GE1L1	Physics and Chemistry Laboratory	BS	50	50	0	0	3	1.5
7	20CS1L2	Computer Practices Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
8		Universal Human Values 1 - Induction Programme	MC	-	-	-	-	-	-
Total						**15**	**2**	**6**	**20**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20MA1T1	ENGINEERING MATHEMATICS I	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify Eigen values and Eigenvectors and apply orthogonal diagonalization to convert quadratic form to canonical form.	K3	1
CO2	Apply differentiation and integration technique to solve algebraic and transcendental function	K3	2
CO3	Evaluate the total derivative of the function, expand the given as series and locate the maximum and minimum for multivariate function	K5	3
CO4	Solve first order Ordinary Differential Equations and apply them to certain physical situations	K3	4
CO5	Choose appropriate integral techniques to find area and volume of the given region	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3	2	
CO5	3	3		3				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**MATRICES**	**9 + 3**
Eigen values and Eigen vectors of a real matrix – properties of Eigen values and Eigen vectors (without proof) – Cayley-Hamilton theorem (statement and applications) – orthogonal transformation of a symmetric matrix to diagonal form (concept only) – Reduction of quadratic form to canonical form by an orthogonal transformation		
Topic - 2	**DIFFERENTIATION AND INTEGRATION**	**9 + 3**
Basic differentiation formula for algebraic and transcendental functions – derivatives – differentiability rules and properties (without proof) – basic integral formula for algebraic and transcendental functions – integration by parts – partial fraction methods.		
Topic - 3	**FUNCTIONS OF SEVERAL VARIABLES**	**9 + 3**
Total derivatives – Taylor's series expansion – maxima and minima – Lagrange's multipliers method – Jacobian's method		
Topic - 4	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATION**	**9 + 3**
Leibnitz's equations – Bernoulli's equation – equation of first order and higher degree – Clairaut's form – Linear first order differential equations and its applications.		
Topic - 5	**MULTIPLE INTEGRALS**	**9 + 3**
Double integrals: Double integration in Cartesian co-ordinates – change of order of integration – area as a double integration in Cartesian – volume as a triple integral in Cartesian co-ordinates (simple problems)		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, Reprint 2009.
2	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley Sons, 2012.
4	Glyn James., "Advanced Modern Engineering Mathematics", Pearson Education Limited, 2007.
5	N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publication Private Limited, 2009.

OTHER REFERENCES	
1	https://www.slideshare.net/mailrenuka/matrices-and-application-of-matrices
2	https://www.slideshare.net/mailrenuka/matrices-and-application-of-matrices
3	https://youtu.be/wtuq1oSButE
4	https://www.slideshare.net/abhinavsomani3/applications-of-maths-in-our-daily-life-41607055

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CY1T2	ENGINEERING CHEMISTRY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the properties & working techniques along with potential applications.	K2	1
CO2	Choose the appropriate method for specific application in engineering technology.	K3	2
CO3	Analyse new solutions to problems in materials and energy usage in daily life	K4	3
CO4	Identify the structure of unknown/new compounds with their properties.	K3	4
CO5	Categorize the important features of various materials and methods for burgeoning society.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2					1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	2						1	3	3		3		
CO4	3		2					1	3	3		3	2	
CO5	3	2	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**WATER CHEMISTRY**	**9**
Hardness of water – types – units –boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, carbonate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water – Reverse Osmosis.		
Topic - 2	**FUELS AND COMBUSTION**	**9**
Fuels: Introduction - classification of fuels – Combustion- coal – Analysis of coal - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol.		
Topic - 3	**ENERGY STORAGE DEVICES**	**9**
Batteries - Types of batteries – primary battery - dry cell. Secondary battery - lead acid battery, Nickel- Cadmium battery, fuel cells – Hydrogen -Oxygen fuel cell. - Solar energy conversion - solar cells – Application.		
Topic - 4	**SPECTROSCOPY**	**9**
Introduction – Laws of spectroscopy - Block diagram, Instrumentation, Working and application of Visible spectroscopy and Ultra Violet spectroscopy – Infrared spectroscopy – Flame photometry – Atomic adsorption spectroscopy.		
Topic - 5	**ENGINEERING MATERIALS**	**9**
Polymer – Types of polymerization – Preparation, properties, uses of Nylon(6,6), Poly Vinyl Chloride (PVC). Plastics – Types - Rubbers – SBR – Nanomaterial – Synthesis and its applications of Nanomaterial. Abrasives – Classification, Properties- Manufacture of SiC.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	S.S Dara and S.S. Umare ‘Engineering Chemistry’, S.Chand Publication, 2013
2	Jain & Jain ‘Engineering chemistry’ Dhanpat Rai Publishing Company, 2012
3	Shikha Agarwal , Engineering Chemistry, Cambridge University Press, 2015 edition
4	Manas Senapati, Advanced Engineering Chemistry, Firewall Media, 2006

OTHER REFERENCES	
1	https://www.freebookcentre.net/chemistry-books-download
2	https://nptel.ac.in/course.html
3	https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm
4	https://edu.rsc.org/resources/collections/analytical-chemistry-introductions

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20EN1T3	COMMUNICATIVE ENGLISH I	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the rules of grammar to parts of speech, tenses, voices, degrees of comparison, compound nouns and articles	K3	1
CO2	Interpret graphical representation for composing passages and paraphrase technical texts	K4	2
CO3	Analyze different spoken discourses like, short talks, comprehend different dialogues, practice conversation for speaking skills	K4	3
CO4	Examine grammatical errors using correct vocabulary and generating ideas logically on a topic	K5	4
CO5	Develop language and vocabulary effectively for our real-life contexts	K6	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			2	3		3		
CO2						2			2	3		2		
CO3						3			2	2		1		
CO4						2			2	3		2	2	
CO5						3			1	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Grammar Quizzes
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**GRAMMAR AND VOCABULARY**	**9 + 3**
Word formation with Prefix and Suffix – Parts of Speech – Tenses - Voices – Degrees of comparison – Compound Nouns - Basic Vocabulary – Homonyms and Homophones – Articles- Idioms – Phrasal verbs – Subject-Verb Agreement.		
Topic - 2	**LISTENING**	**9 + 3**
Introduction to Listening – Listening Comprehension – Extensive and Intensive listening – Pronunciation – Intonation – Stress – Pause – Rhythm – Short and Long conversations.		
Topic - 3	**SPEAKING**	**9 + 3**
An introduction to Speech sounds – Verbal and Non-verbal Communication – Describing places, people, Technical Processes – Telephonic skills – Different types of Interview – Group Discussions – Debates.		
Topic - 4	**READING**	**9 + 3**
Skimming and Scanning – Reading Newspaper articles – Reading different types of texts – Speed Reading – Reading to identify Stylistic Features (Syntax, Lexis, Sentence Structures) – Comprehension.		
Topic - 5	**WRITING**	**9 + 3**
Introduction to aspects of technical writing – Letter writing – Formal Letters – Job application letter with CV and Resume - Official letters- Business letters- Circular letters- Employment letters – Punctuation – Writing reviews on books and movies – recommendations – Creative writing – email writing.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Board of Editors, Using English, Orient Black Swan, 2015.
2	Practical English Usage, Michael Swan, OUP 1995.
3	Communicative English, J.Anbazhagan Vijay, Global Publishers – Chennai 2018.
4	Effective Communication, Adair, John. London: Pan Macmillan Ltd., 2003.
5	Brilliant Communication Skills, Hasson, Gill. Great Britain: Pearson Education, 2012.

OTHER REFERENCES	
1	http://networketiquette.net/
2	http://www.englishdaily626.com/c-errors.php
3	http://www.dailywritingtips.com/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20PH1T4	ENGINEERING PHYSICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify the extensive properties of solid materials to use in current field.	K2	1
CO2	Identify and develop the knowledge of atoms in solid crystals to apply recent engineering fields.	K3	2
CO3	Describe the fundamentals of lasers, laser systems, their characteristics and diversified applications including industry and medicine.	K4	3
CO4	Demonstrate a mastery of the core knowledge base in thermal physics.	K3	4
CO5	Evaluate the nano materials and its fabrication with behaviour by using advanced technical methods.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1	3	2	3	3	3	3	3		
CO2	2	1				3	2	3	3	3	3	3		
CO3	3	2	2			3	2	3	3	3	3	3		
CO4	2					3	2	3	3	3	3	3		
CO5	3	2				3	2	3	3	3	3	3	3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PROPERTIES OF MATTER**	**9**
Hooke's Law - Stress-Strain Diagram - Elastic moduli - Poisson's Ratio - Expression for bending moment of beam and depression of Cantilever - Expression for Young's modulus by Non-uniform bending and its experimental determination.		
Topic - 2	**CRYSTAL PHYSICS**	**9**
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - growth of single crystals: solution and melt growth techniques.		
Topic - 3	**LASER TECHNOLOGY**	**9**
Introduction – principle of spontaneous emission and stimulated emission, population inversion, pumping mechanism. Laser characteristics - Einstein's A and B coefficients derivation. Two, three and four level systems. Threshold gain coefficient- Component of laser. Solid state laser (Nd:YAG). Diode lasers –Application of laser in science and engineering.		
Topic - 4	**THERMAL PHYSICS**	**9**
Transfer of heat energy - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Lee's disc method - theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.		
Topic - 5	**NANO TECHNOLOGY**	**9**
Introduction to Nano materials- Moore's law- Properties of Nano materials- Quantum well, wire and dot- Fullerene, Carbon Nanotubes- Application of Nanotechnology in industry.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 6th Edition, Thomson Brooks Cole, 2008
2	Charles P. Poole and Frank J.Owens, "Introduction to Nanotechnology", 2nd Edition, Wiley, Delhi, 2008.
3	S.O. Pillai, "Solid state Physics", 6th Edition, New Age International Publishers, 2008.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/115/105/115105099/
2	https://nptel.ac.in/courses/115/106/115106061/
3	https://www.youtube.com/watch?v=_JOchLyNO_w
4	https://www.journals.elsevier.com › Journals
5	https://nptel.ac.in/courses/118/104/118104008/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CS1T5	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the word processing tools with text documents	K2	1
CO2	Organize spreadsheet manipulation tools with sheets also describe the presentation and sliding with layouts	K3	2
CO3	Develop C program using managing input and output operations.	K3	3
CO4	Discover array and string implementation in C	K4	4
CO5	Examine the function and structure concepts in C	K4	5

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				3		3	1	3	3		3		
CO2	3		2		2			1	3	3		3		
CO3	3		2		3			1	3	3		3		
CO4	3							1	3	3		3		
CO5	3				2			1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO MS-WORD AND MS-EXCEL**	**9**

Introduction to word – Creating, editing, saving and printing text documents - Font and paragraph formatting - Simple character formatting -Inserting tables, smart art, page breaks -Using lists and styles-Working with images -Using Spelling and Grammar check -Understanding document properties

Introduction to Spreadsheet basics - Creating, editing, saving and printing spreadsheets -Working with functions & formulas -Modifying worksheets with colour & auto formats -Graphically representing data : Charts & Graphs - Data Menu, Subtotal, Filtering Data -Formatting worksheets -Securing & Protecting spreadsheets

Topic - 2	**MS-POWERPOINT AND INTERNET**	**9**

Introduction to PowerPoint- Opening, viewing, creating, and printing slides -Applying auto layouts -Adding custom animation -Using slide transitions -Graphically representing data : Charts & Graphs -Creating Professional Slide for Presentation.
Internet - Understanding how to search/Google -bookmarking and Going to a specific website -Copy and paste Internet content into your word file and emails -Understanding social media platforms such as Facebook & Many more -learn with best practices

Topic - 3	**C PROGRAMMING BASICS**	**9**

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

Topic - 4	**ARRAYS AND STRINGS**	**9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

Topic - 5	**FUNCTIONS, STRUCTURES AND UNIONS**	**9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion - Structure – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Microsoft Office 2010 In Depth 1st Edition by Joe Habraken (Author) ,2010
2	Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill,2006.
3	"Computer basics absolute beginners"9thEdition, Michale Miller,2019

OTHER REFERENCES	
1	https://youtu.be/ZXAPCy2c33o
2	https://courses.lumenlearning.com/wm-compapp/chapter/internet-and-powerpoint/
3	https://www.geeksforgeeks.org/c-language-set-1-introduction/
4	https://www.studytonight.com/c/string-and-character-array.php
5	https://www.geeksforgeeks.org/difference-structure-union-c/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20GE1L1	PHYSICS & CHEMISTRY LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Physics & Chemistry laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
PHYSICS LABORATORY **(Any Five Experiments)**	
1	Torsional pendulum - determination of moment of inertia and rigidity modulus
2	Determination of young's modulus by non- uniform bending
3	(a) Determination of Wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
4	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
5	Air wedge – determination of thickness of a thin wire.
6	Determination of band gap of a semiconductor.
LIST OF EXPERIMENTS	
CHEMISTRY LABORATORY **(Any Five Experiments)**	
1	Determination of total, temporary and permanent hardness of water by EDTA method.
2	Estimate the dissolved oxygen content of the given water sample by Winkler's method.
3	Determine the chloride content of the given potassium chloride sample using standardized silver nitrate solution.
4	Determination of iron content of the given solution using a potentiometer
5	Determination of strength of acid using conductivity meter.
6	Using conductance measurements, determine the strength of acids in a mixture.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	C. Ramesh Kumar & Y. Devakumari, "Physics Laboratory Manual", Al-Ameen Publications, 2020.
2	N. Jafarulla & C. Krishna Moorthy C "Chemistry Laboratory Manual", Al-Ameen Publications, 2020.

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CS1L2	COMPUTER PRACTICES LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		**RBT Level**
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Computer Practices Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Study Experiment a) Hardware specification and PC Assembly b) Getting connected to internet
2	Word processing a) Documentation creation, Text Manipulation with scientific notation b) Table Creation, Table Formatting and Conversion c) Mail Merge d) Flow Chart Preparation.
3	Spread Sheet a) Charts- Bar Chart, Pie Chart, Line Chart, X,Y-Chart b) Object Inclusion, Picture and Graphics c) Protecting the Document
4	Power Point Presentation and Access a) Creation of Presentation b) Generation of Report Using Access
5	C Programming a) Simple C Program with Data Types, Expressions and Comment Lines b) Programming with Conditional Statements c) Programming with Branching and Looping Statements d) Programming with Arrays and String e) Programming with Function and Structure

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Computer Practices Laboratory manual, Al - Ameen Publications 2020
2	Microsoft Office 2008 In Depth 2nd Edition by Joe (Author) , 2010

OTHER REFERENCES	
1	https://youtu.be/ftyWKjT20S4
2	https://nptel.ac.in/about_nptel.html
3	https://nptel.ac.in/courses/106/106/106106092/

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA2T1	Engineering Mathematics II	BS	50	50	3	1	0	4
2	20EN2T3	Communicative English II	HS	50	50	3	0	0	3
3	20EE2T4	Basics of Electrical Engineering	ES	50	50	3	0	0	3
4	20CSCT5	Python Programming	ES	50	50	3	0	0	3
LABORATORY COURSES									
5	20EM2L1	Engineering Practices Laboratory	ES	50	50	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	ES	50	50	0	0	3	1.5
7	20CS2L3	Python Programming Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
8	20CY2T2	Environmental Sciences	MC	100	-	3	0	0	0
Total						**15**	**1**	**9**	**17.5**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all	20MA2T1	**ENGINEERING MATHEMATICS II**	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		**RBT Level**	**Topics Covered**
CO1	Solve higher order differential equations and apply them to certain physical situations	K3	1
CO2	Apply various integral theorems for solving engineering problems involving cubes and parallelepipeds.	K3	2
CO3	Solve linear differential equations using Laplace transform techniques.	K3	3
CO4	Construct analytic function of complex variables and transform functions from z-plane to w- plane and vice-versa using conformal mappings. .	K3	4
CO5	Apply the techniques of complex integration to evaluate real and complex integrals over suitable closed paths or contours	K3	5

PRE-REQUISITE	**ENGINEERING MATHEMATICS I**

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3		
CO5	3	3		3				1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SECOND AND HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS**	**9 + 3**
Second order linear differential equations with constant co-efficient – Cauchy equation – Euler equation– Cauchy –Legendre equation– Method of variation of parameters– Solution of simultaneous equation with constant coefficients		
Topic - 2	**VECTOR CALCULUS**	**9 + 3**
Introduction– gradient–directional derivative–divergence and curl–angel between the surfaces–solenoidal and irrotational vector fields–Green's theorem in a plane–Gauss divergence theorem–Stoke's theorem (without proof).		
Topic - 3	**LAPLACE TRANSFORMS**	**9 + 3**
Condition for existence– Transform of elementary function– Basic properties(without proof)– Derivatives and integrals of transforms– Transform of unit step function– Initial and final value theorem(statement only)– Transform of a periodic function– Inverse Laplace transform– Partial fractions method–convolution theorem(statement only)– Solution of linear ODE of second order with constant co-efficients.		
Topic - 4	**ANALYTIC FUNCTIONS**	**9 + 3**
Analytic function – Necessary and sufficient condition – Cauchy Rieman equation (without proof) – Properties of analytic function (statement only) – Harmonic function – Constructions of analytic function – Bilinear transformation – Conformal mappings $w = z + a$, $w = az$, $w = \frac{1}{z}$		
Topic - 5	**COMPLEX INTEGRATION**	**9 + 3**
Cauchy's integral theorem (without proof) –Cauchy integral formula –Taylor's and Laurent's series (without proof) – Singularities –Cauchy's residue theorem – Contour Integration: Circular and Semi circular contour (excluding polar on real axis).		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications New Delhi, 2011
2	JainR.K and Iyengar S.R.K, "Advanced Engineering Mathematics",4th Edition, Narosa Publishing House, New Delhi, Reprint 2014.
3	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2011.
4	Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010..

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all (Except Civil)	20EN2T3	COMMUNICATIVE ENGLISH II	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Initiate and sustain a discussion maintaining appropriate group behaviour, for a given communication scenario.	K5	1
CO2	Speak effectively and express opinions clearly for a given communicative context.	K3	2
CO3	Read different technical and professional texts, infer implied meanings and critically analyse evaluate the ideas presented.	K4	3
CO4	Use functional grammar for improving employment oriented skills. Use appropriate vocabulary and grammatical forms to complete a passage.	K3	4
CO5	Comprehend different spoken experts critically and infer spoken and implied meaning.	K6	5

PRE-REQUISITE	COMMUNICATIVE ENGLISH I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		3		
CO3						3			3	3		3		
CO4						2			3	3		3	2	
CO5						3			3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Grammar Quizzes
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1		**9**

Listening: Listening practice – different types of conversation and answering questions – gap exercises **Speaking:** Introduce one self and others – Opening a conversation **Reading:** Reading a novel, itinerary, Magazine and News papers **Writing:** Formal Letters – Job application letter with CV and Resume **Grammar:** Kinds of Sentences – Sentence Pattern (Parts/ Patterns/ Column Analysis).

Topic - 2		**9**

Listening: Short texts – Listening to situation based dialogues – Listening to talks on engineering - **Speaking:** Sharing information of a personal kind – greeting – taking leave– **Reading:** Comprehension Questions (multiple choice questions and short questions) – short narrative stories - **Writing:** Paragraph Writing – Filling Forms – Basics of Business writing – Placing Orders, Letter of Complaint - **Grammar:** Asking Questions in the Simple Present – Using reference words, Yes/No type questions.

Topic - 3		**9**

Listening: Listening to academic lectures and live speech – advertisements and announcements –**Speaking:** Giving and Justifying opinions – apologizing – Introduction to Presentation – **Reading:** Reading Blogs – Website articles – Paragraphing – **Writing:** Tweets – Texting and SMS language – Use of Sequence Words - **Grammar:** Using Past Tense to make correct sentences – WH questions.

Topic - 4		**9**

Listening: Listening to a telephone conversation – Documentaries and making notes – **Speaking:** Giving Instructions – Role play – Asking about routine actions – **Reading:** Reading detailed comprehension - **Writing:** Writing Reports – Preparing Checklist - **Grammar:** Make sentences from Future Tense and their Usages (Compare the sentences with Degrees of Comparison).

Topic - 5		**9**

Listening: Viewing a model group discussion and reviewing the performance of each participant – Casual Conversation - **Speaking:** Participating in a Group Discussion – Speeches for special Occasions– **Reading:** Making notes from long passage or any form of written materials – providing a suitable title – **Writing:** Brainstorming **–** Writing short essays - **Grammar:** Numerical Adjectives – Misspelled Words – Direct and Indirect speech – Spot the Errors.

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Dr. Elango et al. "Resonance: English for Engineers and Technologist", Foundation, Chennai, 2013.
2	Anderson, Paul V., "Technical Communication: A Reader-Centered Approach", Cengage.
3	Sharma, Sangeetha and Binod Mishra**,** "Communication Skills for Engineers and Scientists", PHI Learning , New Delhi, 2009.
4	"Exercises in Spoken English Part I –III". EFLU, Hyderabad, OUP, 2014.
5	Raman, Meenakshi, & Sangeeta Sharma. Technical Communication: Principles and Practice, Second Edition. New Delhi: Oxford University Press, 2011.

OTHER REFERENCES	
1	http://www.owlnet.rice.edu/
2	http://zzyx.ucsc.edu/archer/intro.html
3	http://www.indiabix.com/group-discussion/topics-with-answers/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. MECH, CSE & IT	20EE2T4	BASICS OF ELECTRICAL ENGINEERING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate and articulate the basic concepts related electrical machines.	K2	1
CO2	Apply the laws of electromagnetic & electric circuits in electrical machines.	K3	2
CO3	Compare electrical machines to rate their performance.	K4	3
CO4	Analyze electrical machines to infer their limitations.	K4	4
CO5	Evaluate a machines based on a set of criteria / applications and recommend a suitable electrical systems.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2			1	3	3		3		2
CO2	3	3	2	2	3	3		1	3	3		3		2
CO3	3	3	2		2			1	3	3		3		
CO4	3	2	3			2		1	3	3		3		
CO5	3	2	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ELECTRICAL CIRCUITS & MEASURMENTS**	**9**
Ohm's Law – Kirchoff's Laws — Introduction to AC Circuits – Operating Principles of Moving Coil and Moving Iron Instruments, Dynamometer type Wattmeter and Energy meters		
Topic - 2	**DC MACHINES**	**9**
Construction, Principle of Operation and Characteristics of DC Generators, DC Motors, Single Phase Transformer.		
Topic - 3	**AC MACHINES**	**9**
Construction, Principle of Operation of AC Generators (Sailent& Non Sailent), Synchronous motor, Single and three phase induction Motors.		
Topic - 4	**STARTING METHODS**	**9**
Types of DC Motor starters (Two point, Three point & Four point) –Soft starter - Three phase squirrel cage and slip ring induction motors. (DOL Starter, Auto Transformer Starter, Rotor resistance Starter and Star/Delta Starter)		
Topic - 5	**CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC. & AC DRIVES**	**9**
Armature and field control, Ward Leonard Scheme, Single phase rectifier controllers (half and Full), Slip power recovery scheme, Single phase voltage regulator.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	A.K.Shawney, "A Course in Electrical and Electronics Measurements & Instrumentation", Dhanpat Rai & Co. 2010.
2	Bhattacharya, "Electrical Machines", Tata McGraw Hill, 2013.
3	Bakshi, "Electrical Machines –II", Technical Publications , Pune, 2015.
4	Dubey, "Fundamental of Electrical Drives", Narosa Publications, New Delhi, 2011.

OTHER REFERENCES	
1	https://youtu.be/u1gAh0cznp4
2	https://youtu.be/zs4MnEx7wTQ
3	https://youtu.be/shJAV59NS6k
4	https://youtu.be/j_F4limaHYI
5	https://youtu.be/AQqyGNOP_3o

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to CSE/IT	20CSCT5	PYTHON PROGRAMMING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify and make use of python programming elements to solve and debug simple logical problems.	K2	1
CO2	Experiment with the various control statements in Python.	K3	2
CO3	Develop python programs using functions and strings.	K3	3
CO4	Experiment with the usage of pointers and functions.	K3	4
CO5	Analyze a problem and use appropriate packages and modules to solve it.	K4	5

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3			2	3	2	3	3	3	3	3		
CO2			2			3	2	3	3	3	3	3		
CO3			2			3	2	3	3	3	3	3		2
CO4			2		2	3	2	3	3	3	3	3	2	2
CO5	3	3	2			3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**BASICS OF PYTHON PROGRAMMING**	**9**
Introduction - Python Interpreter - Interactive and script mode -Values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments.		
Topic - 2	**CONTROL STATEMENTS AND FUNCTIONS IN PYTHON**	**9**
Conditional (if), alternative (if-else), chained conditional (if-elif-else) – Iteration - while, for, break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.		
Topic - 3	**DATA STRUCTURES: STRINGS,LISTSAND SETS**	**9**
Strings - String slices, immutability, string methods and operations –Lists - creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions - list processing - list comprehension, searching and sorting, Sets - creating sets, set operations		
Topic - 4	**DATA STRUCTURE STUPLES, DICTIONARIES**	**9**
Tuples - Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value – Dictionaries - operations and methods, Nested Dictionaries.		
Topic - 5	**FILES,MODULES,PACKAGES**	**9**
Files and Exception - Text files, reading and writing files, format Operator – Modules - Python Modules - Creating own Python Modules - packages, Introduction to exception handling.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Ashok NamdevKamthane,Amit Ashok Kamthane, “Programming andProblem Solving with Python” , Mc-Graw Hill Education,2018.
2	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second edition, Updated for Python 3, Shroff / O’Reilly Publishers,2016.
3	Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt.Ltd.,2016.
4	Timothy A. Budd,” Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,2015.
5	Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning,2012.

OTHER REFERENCES	
1	https://www.coursera.org/specializations/python
2	https://www.youtube.com/watch?v=rfscVS0vtbw
3	https://nptel.ac.in/courses/106/106/106106212/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., (Common to all)	20EM2L1	ENGINEERING PRACTICES LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Engineering Practices Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	**GROUP A (CIVIL & MECHANICAL) I. CIVIL ENGINEERING PRACTICE** **Buildings:** a) Study of plumbing and carpentry components of residential and industrial buildings safety aspects. **Plumbing Works:** a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings. b) Preparation of plumbing line sketches for water supply and sewage works. c) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components. d) Demonstration of plumbing requirements of high-rise buildings. **Carpentry using manual and power tools:** a) Study of the joints in roofs, doors, windows and furniture. b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
2	**II.MECHANICAL ENGINEERING PRACTICE** **Welding:** a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding. b) Gas welding practice **Basic Machining:** a) Simple Turning and Taper turning b) Drilling Practice **Sheet Metal Work:** a) Forming & Bending b) Model making – Trays and funnels. c) Different type of joints. **Machine Study practice:** a) Study of centrifugal pump b) Study of air conditioner
3	**GROUP B (ELECTRICAL AND ELECTRONICS)** **III.ELECTRICAL ENGINEERING PRACTICE** 1. Testing and connection of Fluorescent lamp wiring. 2. Stair case wiring. 3. Measurement of energy using single phase energy meter. 4. Assembly of Residential house wiring. 5. Measurement of earth resistance of an electrical equipment using meggar.
4	**IV.ELECTRONICS ENGINEERING PRACTICE** 1. Resistor colour coding & Measurement of AC signal parameters (Peak-Peak, RMS period, Frequency) using CRO. 2. Study of logic gates AND, OR, EX-OR and NOT. 3. Measurement of ripple factor of HWR and FWR. 4. Soldering practice for Components, Devices and Circuits. **5.** Generation of Clock Signal.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Engineering Practices Laboratory", Al-Ameen Publications, 2020.

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., (Common to all)	20ME2L2	ENGINEERING DRAWING LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Engineering Drwaing Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Drawing three problems based on projection of lines using Drawing sheet
2	Drawing three problems based on projection of planes using Drawing sheet
3	Drawing three problems based on projection of solids using Drawing sheet
4	Drawing three problems based on Orthographic projection using Software Package
5	Drawing three problems based on Isometric projection using Software Package
6	Detailed Study Of Drawing sheet, Drawing Board, Drawing Instruments.
7	Detailed Study Of Dimensioning, Arrow Head , Lettering

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	R.K. Dhawan, "A text book of Engineering Drawing" ,S.Chand Publishers, Delhi,2010.
2	Dhananjay. A.Jolhe, " Engineering Drawing with an introduction to AutoCAD", Tata McGrawHill Publishing Company Ltd., Delhi,2008.
3	BasantAgarwal and Agarwal.C.M., "Engineering Drawing"Tata McGrawHill Publishing Company Ltd., Delhi,2008.

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to CSE/IT	20CS2L3	PYTHON PROGRAMMING LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Python Programming Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Implement simple python programs using interactive and script mode.
2	Develop python programs using id( ) and type( )functions
3	Implement range ( ) function in python
4	Implement various control statements in python.
5	Develop python programs to perform various string operations like concatenation, slicing, indexing.
6	Demonstrate string functions using python.
7	Implement user defined functions using python.
8	Develop python programs to perform operations on list
9	Implement dictionary and set in python
10	Develop programs to work with Tuples.
11	Create programs to solve problems using various data structures in python.
12	Implement python program to perform file operations.
13	Implement python programs using modules and packages

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	"Python Programming Laboratory Manual", Al-Ameen Publications, 2020
2.	Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018.
3.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016.
4.	Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt.Ltd., 2016.
5.	Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,2015.

OTHER REFERENCES	
1	https://www.coursera.org/specializations/python

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all	20CY2T2	ENVIRONMENTAL SCIENCES	3	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate the importance of interdisciplinary nature of environment and health risk assessment.	K2	1
CO2	Discuss the ecosystem and their importance in the environment and conservation of biodiversity.	K2	2
CO3	Design the rain water harvesting system in their living area.	K6	3
CO4	Analyze the impact of pollution and hazardous waste in a global and societal context.	K4	4
CO5	Understand contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.	K3	5

PRE-REQUISITE	Engineering Chemistry

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1					2	1	3	3		3		
CO2	2	2					1	1	3	3		3		
CO3	3	1	1					1	3	3		3		
CO4	3	2	1					1	3	3		3		
CO5	3	1					2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ENVIRONMENT AND ECOSYSTEMS**	**9**
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs – Introduction, types, characteristic features, structure and function of the forest ecosystem aquatic ecosystems (ponds, river and marine). Activity: Study of the ecosystem structure in Cauvery River.		
Topic - 2	**BIODIVERSITY**	**9**
Introduction to biodiversity definition: genetic, species and ecosystem diversity –value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – In-situ and ex- situ conservation of biodiversity. Activity: Study of common plants, insects, birds.		
Topic - 3	**ENVIRONMENTAL POLLUTION**	**9**
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Thermal pollution (d) Noise pollution – solid waste management: causes, effects and control measures of municipal solid wastes – Hazardous and biomedical waste management -pollution case studies. Activity: Study of air and water pollution in industry.		
Topic - 4	**NATURAL RESOURCES**	**9**
Forest resources: over-exploitation, deforestation, – Water resources: Rain water harvesting-watershed management - utilization of surface and ground water, conflicts over water, dams-benefits and problems Food resources: effects of modern agriculture, fertilizer-pesticide problems - Principles of Green Chemistry- Case studies Activity: Tree plantation and maintenance within the campus.		
Topic - 5	**SUSTAINABILITY AND POPULATION**	**9**
From unsustainable to sustainable development – environmental Impact Assessment (EIA) – environmental ethics: Issues and possible solutions – climate change, acid rain, ozone layer depletion, and case studies – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act - environment and human health – value education – HIV / AIDS – women and child welfare. Activity: Small group meetings about environment and human health in local area peoples and making poster and short films about HIV / AIDS – women and child welfare.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Erach Bharucha,"Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad,2015.
2	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
3	Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill Education, 2014.

OTHER REFERENCES	
1	https://www.onlinebiologynotes.com/food-chain-food-web-and-ecological-pyramids/
2	https://vikaspedia.in/energy/environment/biodiversity-1/conservation-of-biodiversity
3	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/ozone-layer-depletion

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA3T1	Probability and Queuing Theory	BS	50	50	3	1	0	4
2	20CS3T2	Data Structures & Algorithms	PC	50	50	3	1	0	4
3	20EC3T3	Digital Principles and System Design	ES	50	50	3	0	0	3
4	20CS3T4	Computer Architecture	PC	50	50	3	0	0	3
5	20CS3T5	Object Oriented Programming with Java	PC	50	50	3	0	0	3
LABORATORY COURSES									
6	20CS3L1	Data Structures Laboratory	PC	50	50	0	0	3	1.5
7	20CS3L2	Object Oriented Programming with Java Laboratory	PC	50	50	0	0	3	1.5
8	20EC3L3	Digital Systems Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
9	20MCCT1	Constitution of India	MC	100	-	3	0	0	0
Total						**18**	**2**	**9**	**21.5**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech. IT	20MA3T1	PROBABILITY AND QUEUEING THEORY	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify different types of random processes and use it to find whether it is SSS or WSS.	K2	3
CO2	Relate and apply the concept of probability and random variables and predict probabilities of events in models following normal distribution.	K3	1
CO3	Analyse the situation and select an appropriate queuing model techniques for solving problems based on Little's formula.	K4	4
CO4	Compute correlation between variables, and predict unknown values using regression.	K3	2
CO5	Choose the appropriate methods in a queue discipline to develop a relationship between the queue length and service time distribution Laplace transforms for M/G/1 queue.	K5	5

PRE-REQUISITE	ENGINEERING MATHEMATICS I & ENGINEERING MATHEMATICS II

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3		
CO5	3	3		3				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PROBABILITY AND RANDOM VARIABLES**	**9+3**
Basic concepts of probability – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Exponential and Normal distributions.		
Topic - 2	**TWO – DIMENSIONAL RANDOM VARIABLES**	**9+3**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (statement only).		
Topic - 3	**RANDOM PROCESSES**	**9+3**
Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions		
Topic - 4	**QUEUEING MODELS**	**9+3**
Markovian queues – Birth and death processes – Single and multiple server queuing models – Little‘s formula		
Topic - 5	**ADVANCED QUEUEING MODELS**	**9+3**
Finite source models – M/G/1 queue – Pollaczek khinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Miller. S.L. and Childers. D.G., —“Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2013.
2	Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2011.
3	Oliver . C. Lbe., “Fundamentals of applied probability and random processes” Academic Press, 2007.
4	Taha, H.A., “Operations Research”, 8th Edition, Pearson India Education Services, Delhi, 2009.
5	Donald Gros, John F. Shortle, James M .Thomson, Carl M. Haris.,”Fundamentals of Queueing theory”,4th Edition, Wiley India Pvt Ltd,2013.

OTHER REFERENCES	
1	https://www.cuemath.com/learn/mathematics/probability-in-real-life/
2	https://sciencing.com/examples-of-real-life-probability-12746354.html
3	http://www.iraj.in/journal/journal_file/journal_pdf/14-358-149822091462-64.pdf
4	https://www.cuemath.com/learn/mathematics/probability-in-real-life/
5	https://sciencing.com/examples-of-real-life-probability-12746354.html

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech. IT	20CS3T2	DATA STRUCTURES & ALGORITHMS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the concept of Analysis of Algorithms and analyze various searching algorithms.	K2	1
CO2	Apply the different linear data structures like stack and queue to various computing problems	K3	2
CO3	Understand the uses of various linked list and analyse their performance.	K2	3
CO4	Examine the performance of various trees and analyse their complexities.	K4	4
CO5	List graph structure and understand various operations on graphs and their applicability	K4	5

PRE-REQUISITE	FUNDAMENTALS OF COMPUTING AND PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3						1	3	3		3		2
CO2	2	2						1	3	3	2	2		2
CO3	3	3		3				1	3	3		3	2	
CO4	2	3		3				1	3	3		3		
CO5	2							1	3	3	3	3	3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9+3**

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time- Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Topic - 2	**STACKS AND QUEUES**	**9+3**

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Topic - 3	**LINKED LIST**	**9+3**

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis

Topic - 4	**TREES**	**9+3**

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with Complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Topic - 5	**GRAPHS**	**9+3**

Definitions, Topological Sort, Shortest–path Algorithm, Unweighted Shortest paths ,Dijkstra's Algorithm Minimum Spanning Tree, Prim's Algorithm, Kruskal Algorithm, Application of Depth –First Search, Undirected graphs, Bio connectivity.

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	"Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2	M.A.Weiss, "Data Structures and Algorithm Analysis in C++", FourthEdition, Pearson Education Asia, 2013.4. Deshpande M. V., "Electrical Machines", Prentice Hall India, New Delhi, 2011.
3	"How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.
4	"Data Structures and algorithms in C++"Michael T. Goodrich, Roberto Tamassia, David M.Mount, 2nd edition, Wiley India 2011.

OTHER REFERENCES	
1	https://youtu.be/BBpAmxU_NQo
2	https://www.tutorialspoint.com/stack-adt-in-data-structures
3	http://www.btechsmartclass.com/data_structures/stack-adt.html
4	https://youtu.be/TXkDpqjDMHA
5	https://www.bio-connect.nl/

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech. IT	20EC3T3	DIGITAL PRINCIPLES AND SYSTEM DESIGN	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate and understand the basic concepts of digital systems	K3	1
CO2	Apply and verify the Boolean expression for combinational circuits.	K3	2
CO3	Apply and verify the Boolean expression for sequential circuits	K3	3
CO4	Design and verify the asynchronous sequential circuits.	K6	4
CO5	Describe various programmable logic devices.	K2	5

PRE-REQUISITE	BASICS OF ELECTRONICS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2	2		2	2	3	3		3		
CO2	3		2				2	2	3	3		3		
CO3	3	2			2		2	2	3	3		3	2	
CO4	3	2				2	2	2	3	3		3		
CO5	3	2	2	2			2	2	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**BASIC CONCEPTS OF DIGITAL SYSTEMS**	**9**
Review of Number systems, Number Representation, Binary Arithmetic and Logic gates, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method.		
Topic - 2	**COMBINATIONAL CIRCUITS**	**9**
Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder / Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder – Code Converters.		
Topic - 3	**SYNCHRONOUS SEQUENTIAL CIRCUITS**	**9**
Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Analysis of clocked sequential circuits – State reduction and assignment - Excitation table – Design procedure - Shift registers - Universal shift registers –Ripple counters - Synchronous counters – Ring counter – Johnson Counter.		
Topic - 4	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**	**9**
Algorithmic State Machines (ASM) - Asynchronous sequential logic - Analysis procedure – Circuits with latches – Design procedure – Reduction of State and Flow tables – Race free state assignments – Hazards.		
Topic - 5	**LOGIC FAMILIES AND PROGRAMMABLE DEVICES**	**9**
Introduction to Logic families – ECL, TTL &CMOS - Programmable Logic Devices – Programmable Logic Array(PLA) - Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 4th Edition, 2016.
2	Donald D.Givone, "Digital Principles and Design", Tata Mc-Graw Hill Publishing company limited, New Delhi, 2003.
3	Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education, NewDelhi, 2009.
4	Leach D, Malvino A P &Saha, "Digital Principles and Applications" 8th Edition, Tata McGraw Hill Publishing Company, 2014.
5	John.M Yarbrough, "Digital Logic Applications and Design", Thomson – Vikas Publishing House, New Delhi, 2002.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=aWp8ILQgudI
2	https://www.youtube.com/watch?v=_yHo2qq82P0
3	https://www.youtube.com/watch?v=Mt3AToASuFo
4	https://www.youtube.com/watch?v=L80k-alK58g
5	https://www.youtube.com/watch?v=jrQ1YYgiOTo

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech. IT	20CS3T4	COMPUTER ARCHITECTURE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify the different addressing modes used in a processor.	K3	1
CO2	Illustrate the arithmetic operations.	K2	2
CO3	Classify the control units present in a processor.	K2	3
CO4	Analyze the various performance enhancement techniques of Cache memories.	K4	4
CO5	Classify the hazards and input/output accessing.	K2	5

PRE-REQUISITE	FUNDAMENTALS OF COMPUTING PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					2	2	3	3		3		
CO2	3		2				2	2	3	3		3	2	
CO3	3						2	2	3	3		3		
CO4	3	3					2	2	3	3		3		
CO5		3	2				2	2	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**BASIC STRUCTUTRE OF COMPUTERS**	**9**
Functional Units - Basic Operational Concepts - Bus Structures - Performance - Memory Locations and Addresses - Memory Operations - Instruction and Instruction Sequencing – Addressing Modes - Basic I/O Operations.		
Topic - 2	**ARITHMETIC UNIT**	**9**
Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Positive Numbers - Signed Operand Multiplication - Fast Multiplication - Integer Division - Floating Point Numbers and Operations.		
Topic - 3	**BASIC PROCESSING UNIT**	**9**
Fundamental Concepts - Execution of a Complete Instruction - Multiple Bus Organization - Hardwired Control – Micro programmed Control – Microinstructions- Microprogram Sequencing- Wide Branch Addressing		
Topic - 4	**MEMORY SYSTEM**	**9**
Basic Concepts - Speed, Size and Cost - Cache Memories - Performance Considerations - Virtual Memories - memory management requirements		
Topic - 5	**PIPELINING AND I/O ORGANIZATION**	**9**
Basic Concepts - Data Hazards - Instruction Hazards – Influence on instruction sets - Data path and control considerations - Superscalar operation – Accessing I/O devices- Interrupts – Enabling and disabling interrupts- Handling multiple devices - Direct Memory Access. Case study - ARM interrupt structure		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Carl Hamacher, ZvonkoVranesic and SafwatZaky, “Computer Organization”, 5th Edition, McGraw-Hill,2014.
2	John P.Hayes, “Computer Architecture and Organization”, 3rd Edition, McGraw Hill, 2010.
3	David A.Patterson and John L.Hennessy, “Computer Organization and Design: The hardware software interface”, 5th Edition, Morgan Kaufmann, 2014.
4	“Computer Architecture : A Quantitative Approach “ John L. Hennessy, David A. Patterson Morgan Kaufmann Publishers, 2013

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1	https://onlinecourses.nptel.ac.in/noc18_cs29
2	www.coursera.org

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE, B.Tech. IT & AIDS	20CS3T5	OBJECT ORIENTED PROGRAMMING WITH JAVA	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze a problem and identify classes, objects and the relationships among them	K3	1
CO2	Develop applications using various types of Inheritance and Interfaces	K3	2
CO3	Develop applications or programs using exception handling and multithreading.	K3	3
CO4	Analyze an application and make use of object oriented concepts for its implementation	K4	4
CO5	Develop programs using collections, files and streams in java	K3	5

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3	2	3	3	3	3	3	2	2
CO2			2			3	2	3	3	3	3	3		3
CO3		2				3	2	3	3	3	3	3		
CO4	3	3			2	3	2	3	3	3	3	3	2	2
CO5			2			3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND JAVA**	**9**
Introduction to OOP– Java Fundamentals - Data Types, Variables, and Arrays Operators - Control Statements – Classes – Methods –Constructors- Garbage Collection.		
Topic - 2	**INHERITANCE AND EXCEPTION HANDLING**	**9**
Inheritance – Packages and Interfaces - Exception Handling Fundamentals – Java's Built - in Exceptions - Creating new Exception subclasses.		
Topic - 3	**POLYMORPHISM AND MULTI THREADING IN JAVA**	**9**
Polymorphism- Abstract classes and methods-Overloading-Overriding-final methods and classes –Multithreaded programming –The Thread class and the Runnable Interface- Creating multiple threads-Synchronization-Auto boxing and Annotations (Metadata).		
Topic - 4	**STRING HANDLING ANDCOLLECTION FRAMEWORK**	**9**
String Constructors-String Operations-Generic classes and methods-The Collection Framework- Collections-List-Array List, Linked List, Set-HashzSet, Linked HashSet, Queue-Priority Queue, Map-Hash Map, Sorted Map, Tree Map.		
Topic - 5	**FILES AND STREAMSIN JAVA**	**9**
Files and streams – Byte Stream-I/O Stream, File I/O Stream, Byte Array I/O Stream - Character Stream - File Reader and Writer, Char Array Reader and Writer - Serialization.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	HerbertSchildt, "Java the Complete Reference", Ninth edition Tata McGrawHills, 2014.
2	Paul Deitel and Harvey Deitel, —"Java How to Program (Early Objects)", TenthEdition, Pearson Prentice Hall2014.
3	Timothy Budd, —"An Introduction to Object-Oriented Programming", ThirdEdition, Pearson Education,2008.
4	E.Balaguruswamy,"Programming with Java", Sixth Edition, TMH,2019.
5	Dr.G.TThambi, "Object-Oriented Programming with java", First Edition, Kogent Learning Solutins, 2009.

OTHER REFERENCES	
1	https://www.w3schools.com
2	https://www.javatpoint.com/java-oops-concepts
3	https://www.youtube.com/watch?v=l-yoxklZwfM
4	https://www.youtube.com/playlist?list=PL9ooVrP1hQOHb4bxoHauWVwNg4FweDItZ
5	https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech. IT	20CS3L1	DATA STRUCTURES LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Data Structures Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Implementing sorting algorithms – selection sort, insertion sort, quick sort
2	Implementing Set operations using Linked List
3	Implementing stack using array and Linked List
4	Implementing stack applications (Balancing Parenthesis, Infix to post fix conversion)
5	Implementing queue applications (Job scheduling- FIFO, Round Robin)
6	Implementing priority queue
7	Implementing Binary Search trees
8	Implementing AVL trees
9	Implementing BFS and DFS algorithms

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Data Structures Laboratory- I Manual, Al-Ameen Publications, 2020
2.	"Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
3.	M.A.Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education Asia,2013.4. Deshpande M. V., "Electrical Machines", Prentice Hall India, New Delhi, 2011.
4.	"How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.
5.	"Data Structures and algorithms in C++"Michael T. Goodrich, Roberto Tamassia, David M.Mount, 2nd edition , Wiley India 2011.

OTHER REFERENCES	
1	http://enggedu.com/data_structure_lab_exercise_programs/index.php
2	https://www.slideshare.net/ayeshasaifbhatti/ds-lab-handouts
3	https://mrcet.com/pdf/Lab%20Manuals/CSE/DATA%20STRUCTURES%20LAB.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE, B.Tech. IT & AIDS	20CS3L2	OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Object Oriented Programming With Java Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Write a program to find the factorial of a given number.
2	Write a program to print numbers in sorting order.
3	Create a class Odometer that displays the number of kilometers a vehicle run. Give samples as trip information like number of kilometers travelled, fuel consumption per litre. The task is to find the mileage of the vehicle running at different samples of trip information.
4	Create a class Day that represents day, month and year of the calendar day. The class Day should be able to accept the date, update the date, delete the date from a calendar list of activities. Create a class Time that represents hours, minutes, seconds of a clock. The class Time should accept the time, update the time, delete the time from a list of events created for a day using the Day Class.
5	Write a program on illustration of use of packages
6	Write a program to implement interfaces.
7	Write a program that implements a stack ADT that converts infix expression into postfix expression.
8	Write a program to read a file and displays the file on the screen within line number before each line.
9	Write a program to copy contents of a file into another file using File streams.
10	Write a program for handling Array Index Out of Bounds Exception and Divide-by- zero Exception.
11	Write a program for custom exception creation.
12	Write a program on multi-threading showing how CPU time is shared among all the threads.
13	Write a program for Producer-Consumer problem using threads.
14	Write an applet to handle the mouse events and keyboard events.
15	Write a program to develop a simple calculator. Using Grid layout arrange buttons for the digits and +,-,* % operations. The computation should be performed with a button click “Compute”. Display the result on a text field.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	Object Oriented Programming with Java Laboratory Manual,Al-AmeenPublications,2020
2.	Herbert Schildt, “Java the Complete Reference”, Ninth edition Tata McGraw Hills, 2014.
3.	Paul Deitel and Harvey Deitel, —”Java How to Program (Early Objects)”, Tenth Edition, Pearson Prentice Hall2014.
4.	Timothy Budd, —”An Introduction to Object-Oriented Programming”, Third Edition, Pearson Education, 2008.
5.	E.Balaguruswamy, “Programming with Java”, Sixth Edition, TMH,2019.

OTHER REFERENCES	
1	https://www.w3resource.com/java-exercises/
2	https://www.csie.ntu.edu.tw/~d00922011/java/320/java.html

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech. IT	20EC3L3	DIGITAL SYSTEMS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Digital Systems Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	BASICS OF ELECTRONICS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Verification of Boolean Theorems using basic gates.
2	Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3	Design and implement Half/Full Adder and Subtractor.
4	Design and implement combinational circuits using MSI devices:
5	Bit binary adder / subtractor
6	Parity generator /checker
7	Magnitude Comparator
8	Application using multiplexers
9	Design and implement shift-registers.
10	Design and implement synchronous counters.
11	Design and implement a synchronous counters.
12	Coding combinational circuits using HDL.
13	Coding sequential circuits using HDL.
14	Design and implementation of a simple digital system (Mini Project).

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	"Digital Systems Laboratory Manual",Al-AmeenPublications,2020
2	M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 4th Edition, 2016.
3	Donald D.Givone, "Digital Principles and Design", Tata Mc-Graw Hill Publishing company limited, New Delhi, 2003.
4	Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education, New Delhi, 2009.
5	Leach D, Malvino A P &Saha, "Digital Principles and Applications" 8th Edition, Tata McGraw Hill Publishing Company, 2014.
6	John.M Yarbrough, "Digital Logic Applications and Design", Thomson – Vikas Publishing House, New Delhi, 2002.

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1	https://www.youtube.com/watch?v=bn2nNsuMZGk
2	https://www.youtube.com/watch?v=lwt5mXyZoY8&list=PLe_7x5eaUqtVgVnAccC-emHekNNzVbHq_
3	https://www.youtube.com/watch?v=fPxxv7qahY4
4	https://www.youtube.com/watch?v=xAE1qUg0X98
5	https://www.youtube.com/watch?v=72hVxURaQVY

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech. IT	20MCCT1	CONSTITUTION OF INDIA	3	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand and abide the rules of the Indian constitution.	K2	1
CO2	Understand the functions of Central government.	K2	2
CO3	Understand the function of state government.	K2	3
CO4	Understand the various constitutional functions and laws.	K2	4
CO5	Understand the different culture among the people of India	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	2	3	3		3		1
CO2						1	2	2	3	3		3		1
CO3						1	2	2	3	3		3		1
CO4						1	2	2	3	3		3		1
CO5						1	2	2	3	3		3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Role of the Election Commission.

Topic - 2	**STRUCTURE AND FUNCTION OF CENTRAL AND STATE GOVERNMENT**	**9**

Union Government – Structures of the Union Government and Functions – President – Vice President– Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

Topic - 3	**CONSTITUTION FUNCTIONS OF INDIA AND INDIAN SOCIETY**	**9**

Indian Federal System – Central – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India. Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections

Topic - 4	**POLICIES AND ACTS – GENERAL**	**9**

Insurance and Bonding – Laws Governing Sale, Purchase and use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax , Excise and Custom duties and their Influence on Construction Cost – Legal Requirements for Planning – Property Law– Agency Law – Local Government Laws for Approval.

Topic - 5	**POLICIES AND ACTS ON INFRASTRUCTURE DEVELOPMENT**	**9**

A Historical Review of the Government Policies on Infrastructure – Current Public Policies on Transportations – Power and telecom Sector – Plans for Infrastructure Development – Legal framework for Regulating Private Participation in Roads and Highways – Ports and Airport and Telecom.

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi,2018.
2	R.C.Agarwal, "Indian Political System", S.Chand and Company, New Delhi, 2004
3	Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi,2007
4	K.L.Sharma, "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi,2006.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106/105/106105034/
2	https://www.youtube.com/watch?v=6XTYoZymbwE
3	https://www.youtube.com/watch?v=MP6VlAE_7WY

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20EC4T1	Microprocessor and Microcontroller	ES	50	50	3	0	0	3
2	20CS4T2	User Interface Design	PC	50	50	3	1	0	4
3	20CS4T3	Database Management Systems	PC	50	50	3	0	0	3
4	20CS4T4	Operating Systems	PC	50	50	3	1	0	4
5		Open Elective - I	OE	50	50	3	0	0	3
LABORATORY COURSES									
6	20ENCL1	Communication Skills Laboratory	HS	50	50	0	0	2	1
7	20CS4L2	Database Management Systems Laboratory	PC	50	50	0	0	3	1.5
8	20CS4L3	Operating Systems Laboratory	PC	50	50	0	0	3	1.5
MANDATORY COURSE									
9	20HSCT1	Universal Human Values 2: Understanding Harmony	HS	100	-	2	1	0	3
Total						**17**	**3**	**8**	**24**

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. CSE & B.Tech. IT	20EC4T1	MICROPROCESSOR AND MICROCONTROLLER	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Describe the basic concept of 8085 microprocessor architecture and instruction sets of 8085	K2	1
CO2	Describe the basic concept of 8086 microprocessor and minimum/maximum modes of 8086	K2	2
CO3	Examine the different Peripherals Interfaced with the 8085 processor	K3	3
CO4	Describe the basic concept of architecture of 8051 microcontroller	K2	4
CO5	Demonstrate the various interfacing of 8051 interfacing	K3	5

PRE-REQUISITE	DIGITAL PRINCIPLES AND SYSTEM DESIGN

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			2				1	3	3		3	2	
CO2	3			2				1	3	3		3	2	
CO3		2	3	2				1	3	3	2	3	2	
CO4	3		3	3				1	3	3		3	2	
CO5		2	3	3	2	2	2	1	3	3	2	3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**8 BIT MICROPROCESSOR**	**9**
8085 architecture- Timing diagrams – ROM/ RAM Interfacing – Decoding of memory addresses Interrupts – Vector interrupts – ISS - instruction set- Programming with 8085.		
Topic - 2	**16 BIT MICROPROCESSOR**	**9**
Architecture of 8086 – 8086 in MIN/ MAX mode – Addressing modes- Instruction set - Programming with 8086		
Topic - 3	**PERIPHERALS AND INTERFACING WITH 8085**	**9**
Serial and parallel I/O (8251 and 8255) – Programmable DMA controller (8257) Programmable interrupt controller (8259) – Keyboard and Display controller (8279) - Timer (8253) - ADC/ DAC interfacing.		
Topic - 4	**MICROCONTROLLER**	**9**
INTEL 8051 Architecture – 8051 Microcontroller hardware-Ports and Circuits-External memory Counter and timers – Serial data I/O – Interrupts – Instruction set - Programming examples - Applications of 8051.		
Topic - 5	**MICROPROCESSOR BASED APPLICATIONS**	**9**
Temperature controller - Stepper motor control – Traffic light control– Robotics and Embedded Control- Washing machine Control - Mining Problem - Turbine motor.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Ramesh S.Gaonkar, " Microprocessor - Architecture, Programming and Applications with the 8085 ",Prentice Hall, fifth edition,2002.
2	Krishna Kant , "Microprocessors and Microcontrollers ", PHI ,2014.
3	Douglas V.Hall, "Microprocessors and Interfacing: Programming and Hardware ", Tata McGraw Hill, second edition,2010.
4	Barrey B.Brey, "The INTEL Microprocessor 8086/8088, 80186,286,386,486, Pentium and Pentium Pro processor – Architecture, Programming and Interfacing ", Pearson Education Asia ,Eigth edition,2009.
5	Myke Predko" Programming and Customizing the 8051 Microcontroller ", Tata McGraw- Hill Edition ,1999.

OTHER REFERENCES	
1	https://youtu.be/1m-jgtGetl4
2	https://youtu.be/QP-4FlwNTvw
3	https://youtu.be/5fESTph5gA8
4	https://youtu.be/mZItfJIEFMk
5	https://youtu.be/t3thKRqMK2M

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. CSE & B.Tech. IT	20CS4T2	USER INTERFACE DESIGN	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the characteristics of graphical and web user interface in designing a user interface for an application	K2	1
CO2	Develop an effective user interface considering human characteristics, interaction speeds and business functions in relevance to design standards and guidelines	K3	2
CO3	Develop system menus, navigation schemes, windows, buttons, text boxes, selection controls and presentation controls for a user interface.	K3	3
CO4	Demonstrate the use of multimedia system components in creating text, graphics, icons, images and video for web pages.	K2	4
CO5	Develop test cases and evaluate the working system of windows layout for a mobile user interface.	K3	5

PRE-REQUISITE	OBJECT ORIENTED PROGRAMMING WITH JAVA

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	3	2	2	2	3	3	2	3	3	3
CO2	3	3	2	-	2	-	2	2	3	3	2	3	-	2
CO3	3	-	3	-	3	-	2	2	3	3	-	3	-	2
CO4	3	3		-	-	-	2	2	3	3	-	3	-	2
CO5	3	2	2	-	-	-	2	2	3	3	-	3	-	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO USER INTERFACE**	**9+3**
Defining the User Interface – Importance and Benefits of Good Design - Graphical User Interface – Direct Manipulation - Characteristics of Graphical User Interface- Characteristics of Web User Interface Principles of User Interface Design.		
Topic - 2	**HUMAN COMPUTER INTERACTION**	**9+3**
Human Characteristics in Design-Human Considerations in Design-Human Interaction Speeds. Business Functions: Business Definition and Requirement Analysis-Determining Basic Business Functions-Design Standards or Style Guides		
Topic - 3	**MENUS AND WINDOWS**	**9+3**
Menus: Structures and Functions-Content, Formatting, Phrasing the menu, Selection and Navigation of menus-Graphical Menus. Windows: Characteristics- Components-Presentation Styles- Types Organizations – Web Systems-Characteristics of Device-Based-Controls - Screen based controls: Buttons Text Boxes-Selection Controls-Presentation Controls. Case Study: Improper and proper presentation of Command buttons, Menu bars and pull-down.		
Topic - 4	**MULTIMEDIA**	**9+3**
Text for web pages- Effective Feedback– Guidance and Assistance– Internationalization– Accessibility-Icons and Multimedia-Choosing colors for textual and statistical graphics screens-Choosing colors for web pages. Case Study: Voice UI.		
Topic - 5	**WINDOWS LAYOUT– TEST**	**9+3**
Organizing and Laying out Screens-Prototypes – Kinds of Tests-Developing and Conducting a Test Analyze, Modify and Retest-Evaluate the Working System. Case Study: Mobile UI.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Wilbert O. Galitz , "The Essential Guide to User Interface Design - An Introduction to GUI Design Principles and Techniques", Second Edition, John Wiley & Sons, Inc.,2018.
2	Soren Lauesen, "User Interface Design: A Software Engineering Perspective", Pearson/AddisonWesley, 2005.
3	Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd.,2002
4	Avram Joel Spolsky, "User Interface Design for Programmers", Apress, 2001

OTHER REFERENCES	
1	https://en.wikipedia.org/wiki/User_interface_design
2	https://www.tutorialspoint.com/software_engineering/software_user_interface_design.htm

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. CSE & B.Tech. IT	20CS4T3	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare File Processing System with Database Systems in terms of performance, scalability and data storage for efficient access of data.	K4	1
CO2	Develop a Database schema using E-R model, Relational model and apply relational algebra operations like selection, projection, join and Cartesian product to solve the given problem.	K3	2
CO3	Develop SQL queries using aggregate functions, nested sub queries, joins and views for the given problem.	K3	3
CO4	Apply Suitable normalization and query optimization techniques to normalize the given relation and to optimize the query for efficient access of data.	K3	4
CO5	Simply serialization and concurrency control mechanisms to avoid deadlock problem in transaction processing.	K4	5

PRE-REQUISITE	DATA STRUCTURE AND ALGORITHMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-		3	2	3	3	3	3	3		2
CO2	3	3	2	2		3	2	3	3	3	3	3		2
CO3	3	2	3	2		3	2	3	3	3	3	3	2	
CO4	3	3	2	2		3	2	3	3	3	3	3		
CO5	3	2				3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DATABASE SYSTEM**	**9**
Overview of File Processing System – Purpose of Database System – view of data – Data Models- Database Languages – Database System Architecture – Database users and Administrator.		
Topic - 2	**DATA BASE DESIGN**	**9**
Database design & E-R Model: Entity-Relationship model (E-R Model)-E-R Diagram-Constraints-Extended E-R features. Introduction to Relational Model: Database schema-Keys-Schema Diagrams-Relational Query Languages –Relational Operations.		
Topic - 3	**SQL**	**9**
SQL Standards-Data types- Structure of SQL queries-Additional basic operations –set operation-null values-aggregate function- nested sub queries-modification of the database. Intermediate SQL: Joins-Views - Transactions-Integrity constraints-Authorization-Advanced SQL		
Topic - 4	**NORMALIZATION AND QUERY OPTIMIZATION**	**9**
Relational database design: Functional Dependencies - Normalization and its normal forms- Denormalization - Data Storage : RAID - Tertiary Storage - File organization - Organization of records in files. Query processing-Query optimization.		
Topic - 5	**TRANSACTION MANAGEMENT**	**9**
Transaction concepts - Transaction recovery - Properties of Transaction-Serializability - Concurrency Control - Locking Mechanisms - Two Phase Commit Protocol - Dead lock .Case study: Database connectivity using SQL.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Abraham silberschatz,Henry F.Korth,S.Sundharshan,"Database system concepts",sixthedition,Tata McGraw hill,2011
2	C.J.Date,A.Kannan,S.Swamynathan, "An Introduction to Database System",EighthEdition,pearson Education,2006
3	RamezElmasri and Shamkant B.Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson Addisionwesley, 2007
4	Atul Kahate,"Introdution to database Management system", Pearson Education, New Delhi,2006

OTHER REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc17_cs33/course
2	http://www.db-book.com
3	http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design
4	http://www.iitg.ernet.in/awekar/teaching/cs344fall11/
5	www.w3schools.com/sql/

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. CSE & B.Tech. IT	20CS4T4	OPERATING SYSYEMS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the concepts of CPU scheduling and Process synchronization.	K3	1
CO2	Assume the creation of different virtual machines in a hypervisor	K3	2
CO3	Identify the principles of memory management	K3	3
CO4	Analyze appropriate file system and disk organizations for a variety of computing scenario	K4	4
CO5	Build the features of various open source operating systems.	K3	5

PRE-REQUISITE	OBJECT ORIENTED PROGRAMMING WITH JAVA

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3	2	
CO2		3			3			1	3	3		3		
CO3	3				2			1	3	3		3		2
CO4	3	3						1	3	3		3		
CO5	3	3						1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION AND PROCESS CONCEPT**	**9+3**

Operating System Structure – Operating System Operations – Process Management – Memory Management – Storage Management – Protection and Security – System Structures: Operating System Services – User and Operating System Interface – System Calls – Types of System Calls System Programs. Process Scheduling – Operations on Processes – Inter-process Communication.
Case Study: Kernel data structures for various open source operating systems.

Topic - 2	**MULTITHREADED PROGRAMMING AND PROCESS SCHEDULING**	**9+3**

Overview of threads – Multi core programming-Multithreading Models – Threading Issues Basic Concepts of process scheduling – Scheduling Criteria – Scheduling Algorithms – Multiple- Processor Scheduling – Synchronization – The Critical-Section Problem – Peterson's Solution Synchronization Hardware – Semaphores – Classic problems of Synchronization – Monitors.
Case Study: Linux Scheduling

Topic - 3	**DEADLOCK AND MEMORY MANAGEMENT STRATEGIES**	**9+3**

System Model – Deadlock Characterization – Methods for Handling Deadlock – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock. Swapping – Contiguous Memory Allocation – Paging – Structure of the Page Table- Segmentation

Topic - 4	**VIRTUAL MEMORY MANAGEMENT AND FILE SYSTEM**	**9+3**

Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing File Concept – Access Methods – Directory Structure – File Sharing –Protection

Topic - 5	**IMPLEMENTING FILE SYSTEMS AND SECONDARY STORAGE STRUCTURE**	**9+3**

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management. Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management. Case Study: Linux File system

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Abraham Silberschatz, Peter Baer Galvinand Greg Gagne, " Operating System Concepts", John Wiley & Sons (Asia) Pvt. Ltd, Ninth Edition,2016.
2	Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition Prentice Hall of IndiaPvt. Ltd,2010.
3	H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
4	Harvey M. Deitel, "Operating Systems", Pearson Education Pvt. Ltd, Second Edition, 2002.
5	William Stallings, "Operating System", Pearson Education, Sixth Edition,2012.

OTHER REFERENCES	
1	https://nptel.ac.in/courses
2	https://www.w3schools.in › intro
3	https://www.smartzworld.com/notes/operating system
4	https://www.ncertbooks.guru/operating-system-pdf/
5	https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	Common to All Programmes	20ENCL1	COMMUNICATION SKILLS LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Communication Skills Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Laboratory Practice Sessions
2	Conversation Practice Sessions (To be done as real life interactions)
3	Group Discussion Sessions
4	Interview Sessions
5	Presentation

THEORY	0		TUTORIAL	0		PRACTICAL	30		TOTAL	30

BOOK REFERENCES	
1	Baul Emmerson and Nick Hamilton, 'Five Minute Activities for Business English', Cambridge University Press, New York, 2005.
2.	Arthur Brookes and Peter Grundy, 'Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003.
3.	George, Livingston. 'Using Communication Skills Lab in Enhancing Speaking Skills of Engineering Students' 2018.
4.	NiraKonar: English Language Laboratory: A Comprehensive Manual, PHI Learning, 2011.
5.	Pandey, Dr.Meenu. 'A Practical Book of Communication Skills', NIRALI Prakashan advancement of knowledge, second edition 2018.

OTHER REFERENCES	
1	Khan Academy Videos on English Speaking and Writing
2	https://learningenglish.britishcouncil.org/en/listening
3	Adrian Duff et.al. (ed.): Cambridge Skills for Fluency
4	Mark Hancock: English Pronunciation in Use
5	Audio Cassettes/CD'S OUP 2004

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. CSE & B.Tech. IT	20CS4L2	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Database Management Systems Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	DATA STRUCTURES LABORATORY

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Working basic SQL commands (DDL and DML).
2	Demonstrate Transaction control commands and aggregate functions
3	Implementing Join operation and Nested Queries
4	Implementing SQL queries on Integrity constraints and Views
5	Design a database using first and second normal form
6	Apply the concepts of High level programming language extensions (Control structures and Exceptions).
7	Create Cursors and Triggers
8	Demonstrate Procedures and Function in PL/SQL block.
9	Database Design and implementation with any one front end tool (Mini Project)
	Sample list of Projects:
1	Airline Reservation systems
2	Food Ordering System
3	Accident Management System
4	Grade Report System
5	Smart Health Consulting system etc

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	Database Management Systems Laboratory Manual, Al-Ameen Publications, 2020.
2.	Abraham Silberschatz, Henry Korth, and S. Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill.2016.
3.	R. Elmasri and S. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education, 2011.
4.	Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3nd Edition, McGraw Hill, 2003.
5.	Thomas M. Connolly and Carolyn E. Begg, “Database Systems - A Practical Approach to Design, Implementation and Management”, Fifth edition, Pearson Education, 2010.

OTHER REFERENCES	
1	www.w3schools.com
2	www.w3resource.com
3	https://www.scribd.com/document/474661494/CA-01-DBMS-LAB-Reference-manual
4	https://dbmslabnmit.wordpress.com/

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. CSE & B.Tech. IT	20CS4L3	OPERATING SYSTEMS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Operating Systems Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	OBJECT ORIENTED PROGRAMMING WITH JAVA LAB

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Implementation of process scheduling
2	Illustrated of inter process communication strategies
3	Implementation of mutual exclusion by semaphores
4	Deadlock prevention &avoidance algorithms
5	Virtual memory: paging and segmentation
6	Implementation of page replacement algorithms
7	Implementation of disk scheduling algorithms
8	Implementation of file structures

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Operating systems Laboratory,Al-Ameen Publications 2020
2.	Abraham Silberschatz, PeterBaer Galvinand Greg Gagne, “Operating System Concepts”, John Wiley & Sons (Asia) Pvt. Ltd, Ninth Edition,2016.
3.	Andrew S. Tanenbaum, “Modern Operating Systems”, Third Edition Prentice Hall of India Pvt. Ltd,2010.
4.	H.S. Kalsi, ‘Electronic Instrumentation’, McGraw Hill, III Edition 2010.
5.	Harvey M. Deitel, “Operating Systems”, Pearson Education Pvt. Ltd, Second Edition, 2002.

OTHER REFERENCES	
1	https://studentsfocus.com/os-lab-manual-operating-systems-laboratory
2	https://codex.cs.yale.edu/avi/os-book/OS9/practice-exer-dir/index.html
3	https://usermanual.wiki/Pdf/OS20Lab20Manual202017modified.1843321062/
4	https://www.sourcecodesolutions.in/2010/09/cs1254-operating-system-lab.html
5	https://sites.google.com/site/uopops/pm

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. / B.Tech., Common to all	20HSCT1	UNIVERSAL HUMAN VALUES 2 : UNDERSTANDING HARMONY	2	1	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand and aware of themselves, and their surroundings (family, society, nature)	K2	1
CO2	Build more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind	K3	2
CO3	Relate the critical ability and sensitive to their commitment towards what they have understood (human values, human relationship and human society).	K2	3
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	K3	4
CO5	Appraise local, regional and a national culture in harmony with others	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3					2	2	3	3		3		
CO2		3					2	2	3	3		3		
CO3							2	2	3	3		3		
CO4		2				2	2	2	3	3		3		
CO5							2	2	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**6+3**
1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.		
Topic - 2	**Understanding Harmony in the Human Being - Harmony in Myself!**	**6+3**
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 10. Understanding the characteristics and activities of 'I' and harmony in 'I' 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensure Sanyam and Health.		
Topic - 3	**Understanding Harmony in the Family and Society- Harmony in Human Relationship**	**6+3**
13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 14. Understanding the meaning of Trust; Difference between intention and competence 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.		
Topic - 4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**	**6+3**
18. Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature 20. Understanding Existence as Co-existence of mutually interacting units in all pervasive space 21. Holistic perception of harmony at all levels of existence.		

Topic - 5	Implications of the above Holistic Understanding of Harmony on Professional Ethics	6+3

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up

THEORY	30		TUTORIAL	15		PRACTICAL	0		TOTAL	45

BOOK REFERENCES	
1	Jeevan Vidya: E.K. Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3	The Story of Stuff (Book)by Annie Leonard , 2011
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews
7	Economy of Permanence - J C Kumarappa
3	India Wins Freedom - Maulana Abdul Kalam Azad
4	Vivekananda - Romain Rolland (English)
4	Gandhi - Romain Rolland (English)

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=XGxNCFjDGEg
2	https://www.c-span.org/video/?292709-1/the-story-stuff

SEMESTER V

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1		Professional Elective - I	PE	50	50	3	0	0	3
2		Open Elective – II	OE	50	50	3	0	0	3
3	20HSCT2	Professional Ethics	HS	50	50	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
4	20CS5LT1	Computer Network	PC	50	50	2	0	4	4
5	20CS5LT2	Internet of Things	PC	50	50	2	0	4	4
6	20CS5LT3	Web Technology	PC	50	50	2	0	4	4
EMPLOYABILITY ENHANCEMENT COURSE									
7	20PT5T1	Career Guidance - I	MC	100	--	2	1	0	0
Total						**17**	**1**	**12**	**21**

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. CSE	20CS5E1	BASICS OF DATA SCIENCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze data science fundamentals and apply them to day-to-day business and industrial needs	K4	1
CO2	Analyze appropriate probability and statistical tests using R	K4	2
CO3	Apply supervised and unsupervised algorithms in clustering	K3	3
CO4	Develop the mathematical models for data analysis and also perform mining in text data	K3	4
CO5	Apply the visualization models using Tableau and d3.js tools	K3	5

PRE-REQUISITE	DATA STRUCTURES AND ALGORITHM

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		2	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			2	1	3	3		3	2	2
CO5	1	2	3		3		2	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO DATA SCIENCE**	**9**
Data Science Fundamentals, Exploring data engineering pipelines, Applying data science and data warehousing to business and industry		
Topic - 2	**INTRODUCTION TO PROBABILITY AND R**	**9**
Introduction to Probability, Conditional Probability, Random Variable, Statistical Modelling, Probability Distribution, R Introduction, Data Structures in R, Working with Data in R		
Topic - 3	**SUPERVISED AND UNSUPERVISED LEARNING**	**9**
Linear Regressions, Classification- Decision Tree, Naive Bayes, K-Nearest Neighbors, Clustering Identifying Clusters, K-Means Clustering, Hierarchical Clustering		
Topic - 4	**MATHEMATICAL MODELLING**	**9**
Association Rule Mining, Time Series Analysis, Dimensionality Reduction, Principal Component Analysis, Linear Discriminator Analysis, Sentiment Analysis on text data		
Topic - 5	**VISUALIZATION TOOLS**	**9**
Introduction to Visualization - Types of visualizations, Working with Tableau, Creating views in Tableau, using d3.js for data visualization		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, Reprint 2009.
2	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley Sons, 2012.
4	Glyn James., "Advanced Modern Engineering Mathematics", Pearson Education Limited, 2007.
5	N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publication Private Limited, 2009.

OTHER REFERENCES	
1	Lillian Pierson, Data Science for Dummies, John Wiley,2015
2	Garrett Grolemund, Hadley Wickham, R for Data Science, O Reilly in January 2017.
3	Andrie de Vries, Joris Meys, R For Dummies, John Wiley and Sons, 2012
4	David Baldwin, Mastering Tableau, Packt Publishing, 2016.

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E., CSE	20CS5E2	INFORMATION SECURITY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain security principles and components in information management using security SDLC for a business environment.	K2	1
CO2	Identify security threats and attacks and apply a security policy to overcome the threats in a given environment.	K3	2
CO3	Identify and analyze risk factors, vulnerabilities to provide a security solution for managing the risks.	K3	3
CO4	Analyze security models and frameworks and use best practices and standards to develop a security policy for an organization	K4	4
CO5	Apply security technologies for informational protection in an organization.	K3	5

PRE-REQUISITE	DATABASE MANAGEMENT AND SYSTEM

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	2	3	2	1		1	3	3	2	3	2	
CO2	2	1	2		1		2	1	3	3	3	3	2	1
CO3		2		2	1		2	1	3	3		3	2	2
CO4	3		2			2		1	3	3	2	3		
CO5	1		1	3	2	2	2	1	3	3	3	3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SECURITY REQUIREMENTS AND SECURE SDLC**	**9**
What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.		
Topic - 2	**SECURITY INVESTIGATION**	**9**
Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies		
Topic - 3	**SECURITY ANALYSIS**	**9**
Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem.		
Topic - 4	**LOGICAL DESIGN**	**9**
Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.		
Topic - 5	**PHYSICAL DESIGN**	**9**
Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Micki Krause, Harold F. Tipton, — Handbook of Information Security Management, Vol 1-3 CRCPress LLC, 2004.
2	Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposed, Tata McGrawHill, 2003
3	Matt Bishop, — Computer Security Art and Science, Pearson/PHI, 2002.
4	Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Sixth Edition, Cengage Learning, 2017.
5	Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, John Wiley & Sons, 2008.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106106129 ," Introduction to Information Security", Prof. V. Kamakoti
2	https://nptel.ac.in/courses/106106141, " Information Security-II", Prof. V. Kamakoti
3	https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
4	https://www.youtube.com/watch?v=UXMIxCYZu8o
5	https://www.youtube.com/watch?v=Ih9f4MVpPfg

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E., CSE	20CS5E3	SOCIAL NETWORK ANALYSIS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Discover the principles behind the social network analysis using the network features	K4	1
CO2	Explain social network profiles and perform quantitative and qualitative analysis of commercial social network profiles using log files and log mining.	K2	2
CO3	Apply the data mining techniques on social networks analysis to extract the ontological based semantic relationship	K3	3
CO4	Utilize community mining algorithms to predict human behavior for social communities.	K3	4
CO5	Examine random layout, force directed layout, tree layout and matrix representations for visualization of social networks.	K4	5

PRE-REQUISITE	UNIVERSAL HUMAN VALUES

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			1	1	2		1	3	3	2	3	2	
CO2		2		1			2	1	3	3	1	3		
CO3	2		3		3	3		1	3	3		3	2	
CO4	2			2	1	2	2	1	3	3		3		2
CO5	1	2	2				2	1	3	3	2	3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Social Network Analysis: Definition and Features – The Development of Social Network Analysis – Basic Graph Theoretical Concepts of Social Network Analysis – Ties, Density, Path, Length, Distance, Betweenness, Centrality, Clique – Electronic Sources for Network Analysis – Electronic Discussion Networks, Blogs and Online Communities, Web-based Networks – Applications of Social Network Analysis		
Topic - 2	**SOCIAL NETWORKANALYSIS**	**9**
Introduction to Social Networks Profiles – Types of Commercial Social Network Profiles (CSNP) – Quantitative and Qualitative Analysis of CSNP – Analysis of Social Networks Extracted from Log Files – Data Mining Methods Related to SNA and Log Mining – Clustering Techniques – Case Study.		
Topic - 3	**SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS**	**9**
Introduction to Ontology based Knowledge Representation – Ontology Languages for the Semantic Web – RDF and OWL – Modelling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Advanced Representations		
Topic - 4	**SOCIAL NETWORK MINING**	**9**
Detecting and Discovering Communities in Social Network: Evaluating Communities – Methods for Community Detection – Applications of Community Mining Algorithms –Ethical Practices in Social Network Mining – Understanding and Predicting Human Behaviour for Social Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities – Inferential Methods in Social Network Analysis.		
Topic - 5	**VISUALIZATION AND APPLICATIONS OFSOCIAL NETWORKS**	**9**
Visualization of Social Networks Node-Edge Diagrams – Random Layout – Force-Directed Layout – Tree Layout – Matrix Representations –Matrix and Node-Link Diagrams – Hybrid Representations – Visualizing Online Social Networks – Applications – Covert Networks – Community Welfare – Collaboration Networks – Co-Citation Networks – Data Privacy in Social Networks.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	GuandongXu, Yanchun Zhang, Lin Li, “Web Mining and Social Networking Techniques and Applications”, Springer,2011.
2	John Scott, Peter J. Carrington, “The SAGE Handbook of Social Network Analysis”, Sage.
3	Peter Mika, “Social Networks and the Semantic Web”, Springer,2007.
4	BorkoFurht, “Handbook of Social Network Technologies and Applications”, Springer, 2010.
5	Song Yang, Franziska B. Keller, Lu Zheng, “Social Network Analysis: Methods and Examples”, Sage Publication,2016.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106106169/, “Social Networks: The challenge”, Prof. Sudharshan Iyengar, IIT – Ropar
2	https://www.javatpoint.com/social-network-tutorial

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E., CSE	20CS5E4	ADVANCED OPERATING SYSTEM	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Construct the structure and functions of Operating Systems for multiuser environment considering Linux process and thread management as a case study.	K3	1
CO2	Inspect the process scheduling algorithms for a given set of process considering the arrival time, burst time and resources	K4	2
CO3	Analyze the memory allocation techniques and page replacement algorithms for a given reference strings with minimum page fault...	K4	3
CO4	Analyze file allocation methods for efficient file organization considering Linux virtual file system as a case study.	K4	4
CO5	Apply the disk scheduling algorithms with minimum seek time for a given disk request and analyze the architecture of iOS and Android Mobile Operating Systems.	K3	5

PRE-REQUISITE	OPERATING SYSTEM

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1					1	3	3		3		1
CO2		3		3			2	1	3	3	1	3	2	
CO3			2		3		2	1	3	3		3		3
CO4	2					2		1	3	3	2	3	2	
CO5		1					2	1	3	3	3	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**OPERATING SYSTEMS AND PROCESS MANAGEMENT**	**9**
Operating System Overview: Objectives and Functions – Evolution of Operating Systems – Computer Organization – Operating System Operations – Services – System Calls – System Programs – Operating System Structure – OS Generation – System Boot. Processes: Process concept – Process scheduling – Operations on processes – Inter process communication – Threads: Overview – Multicore Programming – Multithreading Models. Case Study: Linux Process and Thread Managements.		
Topic - 2	**PROCESS SCHEDULING AND SYNCHRONIZATION**	**9**
CPU Scheduling: Concepts – Scheduling criteria – Scheduling algorithms. Process Synchronization: The critical section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Monitors. Deadlocks: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock. Case Study: Linux Schedulin		
Topic - 3	**MEMORY MANAGEMENT**	**9**
Main Memory: Background – Swapping – Contiguous memory allocation – Paging – Segmentation. Virtual Memory: Background – Demand paging – Page replacement – Allocation of frames – Thrashing. Case Study: Linux Memory Management.		
Topic - 4	**FILE SYSTEMS**	**9**
File-System Interface: File concept – Access methods – Directory and disk structure – File-system mounting – Sharing and Protection. File-System Implementation: Structure and Implementation – Directory implementation – Allocation methods – Free-space management. Case Study: Linux Virtual File System.		
Topic - 5	**I/O SYSTEMS**	**9**
I/O Systems: I/O Hardware - Mass Storage Structure: Overview, Disk Structure and Attachment - Disk Scheduling and Management – Swap-space management – RAID. Mobile OS : iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2013.
2	William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011.
3	Andrew S. Tanenbaum, “Modern Operating Systems”, Third Edition, Pearson Education, 2009.
4	Harvey M. Deital, “Operating Systems”, Third Edition, Pearson Education, 2004.
5	D M Dhamdhere, “Operating Systems: A Concept-Based Approach”, 3rd Edition, Tata McGraw-Hill Education, 2007

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106108101/ “Introduction to operating system”, Prof P.C.P. Bhatt , IISc-Bangalore
2	https://nptel.ac.in/courses/106106144/2/ “Introduction to operating system”, Prof Chester Rebeiro,IIT-Madras.

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E., CSE	20HSCT2	PROFESSIONAL ETHICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Develop completion of the course; the student should be able to apply ethics in society.	K3	1
CO2	Discover the ethical issues related to engineering and realize the responsibilities and rights in the society.	K4	2
CO3	Dissect how engineering is applied in association with ethics based on engineering experimentation.	K4	3
CO4	Explain the engineering ethics based safety, responsibilities and rights.	K2	4
CO5	Identify the global issues of professional ethics in engineering.	K3	5

PRE-REQUISITE	CONSTITUTION OF INDIA

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	2	3	3	-	3	-	-
CO2	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO3	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO4	-	-	-	-	-	3	2	2	3	3	-	3	-	-
CO5	-	-	-	-	-	2	2	2	3	3	-	3	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**HUMAN VALUES**	**10**
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.		
Topic - 2	**ENGINEERING ETHICS**	**9**
Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas –Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.		
Topic - 3	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9**
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics –A Balanced Outlook on Law.		
Topic - 4	**SAFETY, RESPONSIBILITIES AND RIGHTS**	**9**
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk -Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest –Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.		
Topic - 5	**GLOBAL ISSUES**	8
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –Moral Leadership –Code of Conduct – Corporate Social Responsibility.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Subramanian R., Professional ethics, Oxford University press, 2010
2	Manoharan P.K., Education and Personality Development, APH Publishing Corporation, New Delhi, 2008
3	Megan J. Murphy (Editor), Lorna Hecker (Editor), Ethics and Professional Issues in Couple and Family Therapy.
4	Andrew Belsey (Editor), Ruth Chadwick (Editor), Ethical Issues in Journalism and the Media (Professional Ethics).
5	Warwick Fox (Editor), Ethics and the Built Environment (Professional Ethics)

OTHER REFERENCES	
1	Ruchika Nath, Value Education, APH Publishing Corporation, New Delhi, 2008.
2	https://www.edulearn.net.in/wp-content/uploads/2021/06/PE-1.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. CSE	20CS5LT1	COMPUTER NETWORK	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify the key benefits of block chain for a business or a network environment.	K2	1
CO2	Classify the components of block chain, the roles of the components in developing block chain system and build a new revenue streams to a given business scenario.	K4	2
CO3	Develop the core components of Bit coin Network with the necessary scriplets and Design a Bit coin Wallet for a given P2P network specification.	K3	3
CO4	Assess the Ethereum Eco system, Ethereum Virtual Machine and Encoding schemes and Develop a DApp for a given business model.	K3	4
CO5	Elaborate the given business model and critique the strengths and flaws of block chain implementation.	K4	5

PRE-REQUISITE	DATA STRUCTURES AND ALGORITHMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	2	1	3	3	-	3	-	-
CO2	2	2	-	-	-	-	1	1	3	3	-	3	-	2
CO3	3	-	2	-	-	-	2	1	3	3	-	3	-	-
CO4	2	3	-	-	-	-	2	1	3	3	-	3	2	-
CO5	3	3	2	2	-	-	-	1	3	3	-	3	-	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DATA COMMUNICATIONS**	**6**
Data Communication-Networks–The OSI Model– Layers in the OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media.		
Topic - 2	**DATA LINK LAYER**	**6**
Framing – Error Detection and Correction– IEEE Standards(802.3,802.5,802.11)– MAC protocols and types.		
Topic - 3	**NETWORK LAYER**	**6**
Internetworking: Switching and Bridging – Basic Internetworking-IPv4 - IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) — Interdomain Routing (BGP).		
Topic - 4	**TRANSPORT LAYER**	**6**
Congestion Control and Resource Allocation: TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service: Integrated Services – Differentiated Services.		
Topic - 5	**APPLICATION LAYER**	**6**
Domain Name System - File Transfer – Web Services and SNMP - HTTP - Electronic Mail (SMTP, POP3, IMAP, MIME).		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

COURSE CONTENT	
Experiment - 1	Study of Network simulator 2 (NS2).
Experiment - 2	Implementation of Various Topologies using NS2 Simulator
Experiment - 3	Bit Stuffing and CRC computation
Experiment -4	Program to simulate Stop & Wait protocol.
Experiment - 5	Implementation of Sliding Window Protocol.
Experiment - 6	Program to simulate Distance Vector Routing algorithm.
Experiment - 7	Socket program to implement echo client and echo server using TCP
Experiment - 8	Socket program to contact a given DNS server to resolve a given host name using UDP
Experiment - 9	Configuring a Cisco Router as a DHCP Server
Experiment - 10	Configuring Static and Default Routes
Experiment - 11	Implementing an IP Addressing Scheme
Experiment - 12	Performing an Initial Router Configuration
Experiment - 13	Configure a Network topology using packet tracer software.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	William Stallings, “Data Communication and Networks”, Pearson Education, Tenth edition, 2014.
2	James .F. Kurouse& W. Rouse, “Computer Networking: A Topdown Approach Featuring”,Sixth edition, Pearson Education, 2013.
3	William Stallings, “Data Communication and Networks”, Pearson Education, Tenth edition, 2014.

OTHER REFERENCES	
1	http://www.nptel.ac.in/downloads/106105080, Computer Networks, Prof.Sujoy Ghosh, IIT Kharagpu.
2	https://www.elsevier.com/journals/subjects/computer-science.

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E-CSE	20CS5LT2	INTERNET OF THINGS	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	To acquire specific scripting knowledge to develop interactive applications	K2	1
CO2	To understand basis of android application development	K3	2
CO3	To apply the programming skills in developing application in Agricore	K5	3
CO4	To apply the programming skills in developing application to enable smart cities.	K3	4
CO5	To apply the programming skills in developing application in Healthcare	K4	5

PRE-REQUISITE	INTERNET OF THINGS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	2	2	3	3	2	3	-	-
CO2	1	2	3	2	2	-	2	2	3	3	-	3	-	2
CO3	3	2	2	-	-	-	2	2	3	3	2	3	-	2
CO4	1	3	2	2	-	-	2	2	3	3	-	3	2	-
CO5	3	2	-	-	-	-	2	2	3	3	3	3	-	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF IOT**	**6**
Introduction , Definitions &Characteristics of IOT, IOT Architectures , Physical & Logical Design of IOT ,Enabling Technologies in IOT , History of IOT, About things in IOT, The identifiers in IOT, About the Internet in IOT , IOT frameworks, IOT and M2M		
Topic - 2	**INDUSTRIAL INTERNET APPLICATIONS**	**6**
Industrial internet application:- IOT Fundamentals and components , industrial Manufacturing , monitoring , control , optimization and autonomy , introduction to Hadoop and big data analytics.		
Topic - 3	**APPLICATIONS IN AGRICULTURE**	**6**
Applications in agriculture :- Smart Farming : Weather monitoring , Precision farming , Smart Greenhouse , Drones for pesticides		
Topic - 4	**APPLICATIONS IN IOT**	**6**
Introduction :- Applications in iot enabled smart cities :- Energy consumption , smart energy meters, Home automation , smart grid and solar grid energy harvesting , intelligent parking data lake services scenarios		
Topic - 5	**HEALTH CARE APPLICATIONS**	**6**
Introduction: Architecture of iot for health care, Multiple views coalescence, SBC –ADL to construct the system architecture. Use Cases Wearable devices for remote monitoring of Physiological, ECG, EEG, Diabetes and Blood pressure.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

COURSE CONTENT	
Experiment-1	Implement a program to Blink LED using Arduino.
Experiment-2	Implement a program to control intensity light using Arduino.
Experiment-3	Implement a program for Buzzer indicator using Arduino.
Experiment-4	Implement a program for LDR using Arduino.
Experiment-5	Implement a program for servo motor control using Arduino.
Experiment-6	Implement Measurement and transmission of room temperature with date and time to web server using WiFi module.
Experiment-7	Detection of ethanol and carbon-dioxide in the air using Gas sensors.
Experiment-8	Detection of obstacles using infrared sensors and measure the distance using ultrasonic sensors.
Experiment-9	Tracking the location of a particular object through GPS module and find the speed of a moving object using accelerometer sensor.
Experiment-10	Creation of dashboard to monitor the Smart Lighting using Freedboard io/ PubNub cloud server.

Experiment-11	Program for RGB LED using Arduino
Experiment-12	Experiment on HTTP-to-CoAP semantic mapping Proxy in IoT Toolkit

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Muthusubramanian R, Salivahanan S and Muraleedaharan K A . : "Basic Electrical , Electronics and Computer Engineering ",Tata McgrawHill,second Edition.(2006
2	Olivier Hersent , David Boswarthick, Omar Elloumi , " The Internet of Things : Key applications and protocols " Willey Publications 2nd edition,2013.
3	Marco Schwartz – Internet od Things with the Arduino Yun,Packt Publishing ,2014
4	Adrian McEwen,Hakimcassimally, "Designing the Internet of Things ",Willey Publications 2012.

OTHER REFERENCES	
1	https://en.wikipedia.org/wiki/Internet_of_things
2	https://builtin.com/internet-things
3	https://youtu.be/LlhmzVL5bm8
4	https://youtu.be/6mBO2vqLv38?t=3

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. CSE	20CS5LT3	WEB TECHNOLOGY	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Develop a static web page with appropriate user interface using HTML and CSS.	K3	1
CO2	Apply JavaScript code for validating a static web page at client side with appropriate user interface.	K3	2
CO3	Construct a dynamic web page for server-side programming with appropriate user interface using Servlet and JSP.	K3	3
CO4	Build a web application for business processing using PHP.	K3	4
CO5	Discover a web service for commercial application using XML.	K4	5

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	3	2	3	3	3	3	3	3	-
CO2	2	-	-	-	2	3	2	3	3	3	3	3	-	3
CO3	3	2	2	-	2	3	2	3	3	3	3	3	2	2
CO4	2	3	3	-	3	3	2	3	3	3	3	3	-	3
CO5	3	3	3	2	2	3	2	3	3	3	3	3	3	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT											
Topic - 1	**HTML 5 AND CSS 3**										6
Introduction to HTML - HTML5 – Tables – Lists – Image – HTML5 control elements – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.											
Topic - 2	**CLIENT-SIDE PROGRAMMING**										6
JavaScript: Introduction to scripting – Variables and Data types – Operators – Control statements – Functions – Arrays – Objects.											
Topic - 3	**SERVER-SIDE PROGRAMMING**										6
Java Servlets – Servlet Architecture – Servlet Life cycle – Parameter Data – Introduction to Java Server Pages: Basic JSP – MVC Paradigm.											
Topic - 4	**WEB APPLICATIONS AND DATABASES**										6
PHP – Introduction – String processing – Regular expressions – Form processing & Business logic – Creating a database in MySQL.											
Topic - 5	**WEB DATA REPRESENTATION**										6
XML Introduction – Structuring data – XML namespaces – DTDs – XML Schema – XSL: XPath – XSLT.											
THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**		**30**

COURSE CONTENT	
Experiment- 1	Create a web site for our college with HTML5 and CSS3 (Include Media elements & all types of style sheets).
Experiment- 2	Create a XHTML document for the college website with Text styling, Linking, Images, Lists, Table by highlighting the facilities in the department
Experiment- 3	Create an XHTML document for an online Bookstore that has a Registration form with text box, Radio Button, Selection box, Checkbox, Submit and reset buttons
Experiment- 4	Write a JavaScript code to validate the following fields in an email registration form. ● Name should contain alphabets. ● Password should not be less than 8 characters and include check box to toggle between password visibility (Show password) ● Email-Id should not contain any invalid characters and must follow the standard pattern (user@domain.com) ● Phone number should contain 10 digits only and all the fields must be filled for successful form submission.
Experiment- 5	Write a Java Servlet program to print current date and time of the web server.
Experiment- 6	Write a JSP program to validate the username and password and display the welcome message if login successfully or display an error message.
Experiment- 7	Create a webpage to dynamically load the student information from the database using AJAX with PHP.
Experiment- 8	Develop a simple webpage for calculator using AngularJS.
Experiment- 9	Write a JSP code to retrieve the xhtml form values and print those values in JSP pages.

Experiment- 10	Write a JavaScript function to get nth largest element from an unsorted array.									
Experiment- 11	Write a program to connect a XML web page to any database engine.									
Experiment- 12	Write a program to store the form fields in a database, use any appropriate Server Slide Scripting.									
THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective ", 11th Impression, Pearson Education, 2012.
2	P. J. Deitel, H. M. Deitel, “Internet & World Wide Web How to Program”, Fourth Edition, Eleventh Impression, Pearson Education, 2016.
3	Robert W. Sebesta, “Programming the World Wide Web”, 8th edition, Pearson Education, 2015.
4	Joel Murach and Michael Urban, “Murach's Java Servlets and JSP”,3rd edition, Murach Books, 2014.
5	Luke Welling, Laura Thomson, “PHP and MySQL Web Development”, Fifth Edition, Pearson Education.

OTHER REFERENCES	
1	http://www.nptel.ac.in/courses/106105084/, “Internet Technology”, Prof. Indranil Sengupta, IIT-Kharagpur.
2	https://nptel.ac.in/courses/106101163/45/, “Testing of Web Applications and Web Services”, Prof. Meenakshi D’Souza, IIT- Bombay
3	https://en.wikibooks.org/wiki/Introduction_to_Information_Technology/Web_Technologies
4	https://youtu.be/JLcaX0XlQuI

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. / B. Tech. (CSE, EEE, ECE & IT)	20PT5T1	Career Guidance - I	2	1	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the basic concepts of logical reasoning Skills	K1	1
CO2	Understand the basic concepts of Quantitative Aptitude.	K2	2
CO3	Understand the importance and type of communication in personal and professional environment.	K3	3
CO4	To provide insight into much needed technical and non technical qualities in career planning.	K4	4

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		2		
CO3						3			3	2		1		
CO4						2			3	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Quiz
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	LOGICAL REASONING	5

LR 1: Series, Odd man out, Analogy

LR 2: Coding and Decoding

LR 3: Direction, Ranking and Ordering

LR 4: Blood Relation

LR 5: Venn Diagram, Decision Making

LR 6: Syllogism

Topic - 2	QUANTITATIVE APTITUDE	12
NR 1: Average NR 2: Percentage NR 3: Profit and Loss NR 4: Ages NR 5: Ratio and Proportion NR 6: Allegation and Mixture NR 7: Time and Work NR 8: Time, Speed and Distance NR 9: Trains, Boats and Streams		
Topic - 3	**VERBAL REASONING & BUSINESSES COMMUNICATION**	**3**
VR 1:Preposition & Conjunction VR 2: Synonyms, Antonyms & Tenses BS1: Art of Introduction, Communication Barriers, Personal Interview.		
Topic - 4	**TECHNICAL CODING**	**10**
TECH 1: I/O, Operaters TECH 2: Conditional statement (branching and jumping statement) TECH 3: Control statements and patterns programming TECH 4: 1D and pointers.		

THEORY	20		TUTORIAL	10		PRACTICAL	0		TOTAL	30

BOOK REFERENCES	
1	Logical Reasoning and Data Interpretation for CAT by Nishit K. Sinha
2	Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
3	A Modern Approach To Verbal Reasoning by R S Aggarwal.
4	Computer Programming for Beginners: Fundamentals of Programming Terms and Concepts - Nathan Clark

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=x0WkptLF6oE&list=PLpyc33gOcbVADMKqylI__O_O_RMeHTyNK
2	https://www.youtube.com/watch?v=LMY7GoAMcDI
3	https://www.youtube.com/watch?v=K7sj1yzXzng
4	https://www.youtube.com/watch?v=fyzmCU931QE
5	https://www.youtube.com/c/TechnicalCoding

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS6T1	Block chain Technology	PC	50	50	3	1	0	4
2	20CS6T2	Software Engineering	PC	50	50	3	0	0	3
3		Professional Elective - II	PE	50	50	3	0	0	3
4		Professional Elective - III	PE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
5	20CS6LT1	Compiler Design	PC	50	50	2	0	4	4
6	20CS6LT2	Object Oriented Analysis & Design	PC	50	50	2	0	4	4
EMPLOYABILITY ENHANCEMENT COURSE									
7	20PT6T1	Career Guidance - II	MC	100	--	2	1	0	0
Total						**18**	**2**	**8**	**21**

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. CSE	20CS6T1	BLOCK CHAIN TECHNOLOGY	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify the key benefits of block chain for a business or a network environment.	K3	1
CO2	Classify the components of block chain, the roles of the components in developing block chain system and build a new revenue streams to a given business scenario.	K4	2
CO3	Develop the core components of Bit coin Network with the necessary scriplets and Design a Bit coin Wallet for a given P2P network specification.	K3	3
CO4	Assume the Ethereum Eco system, Ethereum Virtual Machine and Encoding schemes and Develop a DApp for a given business model.	K4	4
CO5	Examine the given business model and critique the strengths and flaws of block chain implementation.	K4	5

PRE-REQUISITE	COMPUTER NETWORKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	1	3	3	-	3	-	-
CO2	2	-	-	-	-	-	-	1	3	3	-	3	-	2
CO3	3	-	2	-	-	-	-	1	3	3	-	3	-	-
CO4	-	3	-	-	-	-	-	1	3	3	-	3	2	-
CO5	3	-	2	2	-	-	-	1	3	3	2	3	-	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**GETTING STARTED WITH BLOCK CHAIN**	9+3
What is Block chain – Centralized Vs. Decentralized Systems – Layers of Blockchain – Why is Block chain Important – Block chain uses and Use Cases.		
Topic - 2	**WORKING OF BLOCK CHAIN**	9+3
Block chain foundation – Cryptography – Game Theory – Merkle Trees – Properties of Block chain solutions – Block chain Transactions – Distributed Consensus Mechanisms – Block chain Applications – Scaling Block chain		
Topic - 3	**WORKING OF BITCOIN**	9+3
History of Money – Dawn of Bit coin – The Bit coin Block chain – The Bit coin Network – Bit coin Scripts – Full Nodes vs SPVs – Bit coin Wallets.		
Topic - 4	**WORKING OF ETHEREUM**	9+3
From Bit coin to Ethereum – Ethereum Blockchain – Merkle Patricia Tree – RLP Encoding – Ethereum Transaction and Message Structure – State Transaction Function – Gas and Transaction Cost – Smart Contracts		
Topic - 5	**ETHEREUM NETWORK**	9+3
Ethereum Virtual Machine – Ethereum Ecosystem : Swarm – Whisper – DApp – Development Components **Hands-On Case study**: DApp – Setting up a Private Ethereum Network: Install go-etherum – Create geth Data directory – Create a geth account.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing
2	Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
3	Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
4	Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O'Reilly Publisher. 22
5	Ron Quaranta, Blockchain in Financial Markets and Beyond: Challenges and Applications, Risk Books Publisher.

OTHER REFERENCES	
1	Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st edition (2015).
2	https://www.edx.org/course/blockchain-and-fintech-basics-applications-and-limitations

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E., CSE	20CS6T2	SOFTWARE ENGINEERING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the software product using suitable software process models for the given specification.	K3	1
CO2	Analyze the requirements for real-time problem specification and devise a SRS pertaining to industry standards.	K4	2
CO3	Examine the system model using the appropriate design engineering procedure for a given SRS	K4	3
CO4	Classify the software model using black box testing, white box testing, unit testing and integration testing to produce error free product.	K4	4
CO5	Examine the development cost, schedule a risk free work plan for a given project model using appropriate tool.	K4	5

PRE-REQUISITE	PROFESSIONAL ETHICS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					2	2	3	3		3	1	3
CO2	3	2					2	2	3	3		3		
CO3	3	2	2	2			2	2	3	3		3	2	3
CO4	3	2	2	2			2	2	3	3		3	2	3
CO5	3	2	2	2			2	2	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**SOFTWARE PROCESS AND AGILE DEVELOPMENT**	**9**
Software Process -Software Process models- Waterfall Model-Incremental Process Models -Evolutionary Process Models- Prototyping-Spiral Model- Introduction to Agility-Agile process.		
Topic - 2	**REQUIREMENTS ANALYSIS AND SPECIFICATION**	**9**
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis - Data Dictionary.		
Topic - 3	**SOFTWARE DESIGN**	**9**
Design process – Design Concepts-Design Model–Architectural Design - User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.		
Topic - 4	**SOFTWARE TESTING**	**9**
Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging.		
Topic - 5	**PROJECT MANAGEMENT**	**9**
Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
2	Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.
3	Kelkar S.A., Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
4	Roger S. Pressman, Software Engineering – A Practitioners Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.
5	Ian Sommerville, Software Engineering, 9th Edition, Pearson Education Asia, 2011.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106101061/
2	https://nptel.ac.in/downloads/106105087/
3	https://en.wikipedia.org/wiki/Software_engineering
4	https://youtu.be/cDQ34z0oqnQ

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E., CSE	20CS6E1	DATA WARE HOUSING AND DATA MINING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Dissect about the necessity of preprocessing and its procedure.	K4	1
CO2	Apply the association rules for mining applications.	K3	2
CO3	Identify an appropriate Classification techniques for various problems with high dimensional data.	K3	3
CO4	Assume an appropriate Clustering techniques for various problems with high dimensional data	K4	4
CO5	Build the various mining techniques on complex data objects.	K3	5

PRE-REQUISITE	DATABASE MANAGEMENT SYSTEMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	1	3	3	-	2	3	-
CO2	3	2	2	-	-	-	-	1	3	3	-	2	3	-
CO3	3	3	3	-	-	-	-	1	3	3	2	3	-	3
CO4	3	3	3	-	-	-	-	1	3	3	2	3	-	3
CO5	3	-	2	-	-	-	-	1	3	3	-	2	3	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**DATA WAREHOUSING AND BUSINESS ANALYSIS**	**9**
Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.		
Topic - 2	**DATA MINING PRIMITIVES AND CONCEPT DESCRIPTION**	**9**
Data mining primitives – Data mining query language - concept description – Data generalization and characterization – Analytical characterization – Mining Descriptive statistical measures in large databases.		
Topic - 3	**CLASSIFICATION AND PREDICTION**	**9**
Introduction – Decision Tree Induction – Bayesian Classification – Back propagation – Lazy Learners – Other classification methods – Prediction – Evaluating the accuracy		
Topic - 4	**CLUSTERING AND ASSOCIATION**	**9**
Similarity and Distance Measures – Hierarchical Algorithms – Partitional Algorithms – Outlier Analysis – Mining Frequent Patterns, Associations, and Correlations		
Topic - 5	**ADVANCED TOPICS**	**9**
Web Mining – Web Content Mining – Structure and Usage Mining – Spatial Mining – Time Series and Sequence Mining – Graph Mining.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Vipin Kumar, Michael Steinbach," Introduction to Data Mining", **S**econd Edition, Addison Wesley, 2005
2	Jiawei. Han, Micheline Kamber, "Data Mining: Concepts and Techniques", Second Edition, Elsevier, New Delhi, 2008.
3	Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw– Hill Edition, Tenth Reprint 2007.

OTHER REFERENCES	
1	http://www.information-management-architect.com/process-architecture.html
2	http://www.cs.ccsu.edu/~markov/ccsu_courses/DataMining-1.html
3	http://www.tutorialspoint.com/data_mining/dm_cluster_analysis.htm
4	http://study.com/academy/lesson/data-warehousing-and-data-mining-information-for-business-intelligence.html

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	BE. CSE	20CS6E2	ETHICAL HACKING AND NETWORK DEFENCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Examine vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks	K4	1
CO2	Discover penetration & security testing	K4	2
CO3	Choose as a professional ethical hacker	K3	3
CO4	Develop the skills to become a security analyst	K3	4
CO5	Identify the security issues in each layer	K3	5

PRE-REQUISITE	COMPUTER NETWORKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2		2		2	2	3	3		3	2	
CO2	3	3	3	2	2		2	2	3	3		3		1
CO3		2		2	2		2	2	3	3		3	2	
CO4	3	2	2	3			2	2	3	3		3	2	
CO5			3	3		2	2	2	3	3		3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**ETHICAL HACKING OVERVIEW AND VULNERABILITIES**	**9**
Understanding the importance of security, Concept of ethical hacking and essential Terminologies Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking.		
Topic - 2	**FOOT PRINTING AND PORT SCANNING**	**9**
Foot printing - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.		
Topic - 3	**SYSTEM HACKING**	**9**
Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.		
Topic - 4	**HACKING WEB SERVICES AND SESSION HIJACKING**	**9**
Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools.		
Topic - 5	**HACKING WIRELESS NETWORKS**	**9**
Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless, DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2	Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010
3	RajatKhare, "Network Security and Ethical Hacking", Luniver Press, 2006
4	Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide", Packet, 3/e
5	Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

OTHER REFERENCES	
1	https://youtu.be/XLvPpirlmEs
2	https://youtu.be/UhjrCluTOA0
3	https://youtu.be/_BSlzCjlSMA

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E., CSE	20CS6E3	KNOWLEDGE MANAGEMENT	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the evolution of knowledge management, challenges, ethical and legal issues and corporate social responsibilities of KM in organizations	K2	1
CO2	Identify the quality of organizational knowledge, knowledge sharing using knowledge market approach	K3	2
CO3	Utilize KM tools and portals to develop a quality knowledge bank/ repository	K3	3
CO4	Analyze KM applications to identify the key components for a successful management	K4	4
CO5	Utilize current trends and develop enterprise knowledge management applications for a business plan.	K3	5

PRE-REQUISITE	CONSTITUTE OF INDIA

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2	2	3	2		2	2	3	3	2	3	2	
CO2	2		2	3	3	3	2	2	3	3		3		2
CO3				3		3	2	2	3	3	1	3	2	
CO4			2	3	2	3	2	2	3	3		3		
CO5		2			3	3	2	2	3	3		3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**KNOWLEDGE MANAGEMENT**	**9**
An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.		
Topic - 2	**CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING**	**9**
Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance		
Topic - 3	**KNOWLEDGE MANAGEMENT-THE TOOLS**	**9**
Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval -Information Coding in the Internet Environment - Repackaging Information.		
Topic - 4	**KNOWLEDGEMANAGEMENT-APPLICATION**	**9**
Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).		
Topic - 5	**FUTURE TRENDS AND CASE STUDIES**	**9**
Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Srikantaiah.T. K., Koenig, M., “Knowledge Management for the Information Professional” Information Today, Inc., 2000
2	Nonaka, I., Takeuchi, H., “The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation”, Oxford University Press, 1995.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/110105076/
2	http://study.com/academy/lesson/knowledge-management-theory-strategies.html

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E., CSE	20CS6E4	REAL TIME SYSTEMS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify real time systems based on the time constraints and controlling programs.	K4	1
CO2	Identify the hardware components and interfaces for the given Real Time Application.	K3	2
CO3	Discover the real time languages with methods for exception handling, co-routines, interrupts and device handling to program the real time system.	K4	3
CO4	Select real time and multi-tasking operating system enabled with Scheduler, Real Time Clock Interrupt Handler, Code Sharing for the given real time system.	K3	4
CO5	Build and develop Real-Time Systems for washing machine, digital camera, smart card system, telephone answering machine, mobile phone software and ATM machine..	K3	5

PRE-REQUISITE	OPERATING SYSTEMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2	2	3	2	2	2	3	3		3	2	
CO2		2		2	3	3	2	2	3	3		3		2
CO3	2				3		2	2	3	3	1	3		
CO4	2			2	3	2	2	2	3	3		3	2	
CO5			2			3	2	2	3	3	2	3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION OF REAL TIME SYSTEMS**	**9**
Historical background – Elements of Computer Control System – RTS Definitions – Classifications of Real Time System – Time Constraints – Classification of Programs. Concepts of Computer Control: Introduction – Sequence Control – Loop Control – Supervisory Control – Centralized Computer Control – Hierarchical Systems.		
Topic - 2	**COMPUTER HARWARE REQUIREMENTS FOR REAL TIME APPLICATIONS**	**9**
Introduction – General Purpose Computer – Single Chip Microcomputers and Microcontrollers – Specialized Processors – Process – Related Interfaces –Data Transfer Techniques – Communications – Standard interface		
Topic - 3	**LANGUAGES FOR REAL TIME APPLICATIONS**	**9**
Introduction – Syntax Layout and Readability – Declaration and Initialization of Variables and Constants – Modularity and Variables – Compilation of Modular Programs – Data Types – Control Structures – Exception Handling – Low-level facilities – Co-routines – Interrupts and Device Handling – Real-Time Support – Overview of Real-Time Languages.		
Topic - 4	**OPERATING SYSTEMS**	**9**
Introduction – Real Time Multi-Tasking OS – Scheduling Strategies – Priority Structures – Task Management – Scheduler and Real-Time Clock Interrupt Handler – Memory Management – Code Sharing – Resource Control – Task Co-Operation and Communication – Mutual Exclusion.		
Topic - 5	**DESIGN OF REAL TIME SYSTEMS**	**9**
Case Studies: Washing Machine – Digital Camera – Smart card System Applications – Telephone Answering machine - Mobile phone software for key inputs- ATM machine.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Stuart Bennet, “Real -Time Computer Control”, 2nd Edition, Pearson Education., 2011.
2	Qing Li. “Real Time Concepts for Embedded Systems”, 2011, Elsevier
3	Phillip. A. Laplante, “Real – Time Systems Design and Analysis”, 2nd Edition, PHI, 2005.
4	C.M. Krishna, Kang G.Shin, “Real – Time Systems”, Edition, MsGraw Hill Internations Editions, 1997.
5	Raj Kamal, “Embedded Systems – Architecture, Programming and Design”, 3rd Edition, Tata McGraw-Hill, India, 2007.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106105172 by Prof.Rajib Mall, Department of Computer Science and Engineering, IIT Kharagpur
2	https://nptel.ac.in/courses/106105036/ by Prof Rajib Mall, Department of Computer Science and Engineering, IIT Kharagpur.

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E., CSE	20CS6E5	DATA HANDLING AND VISUALIZATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Examine the basics of Data Visualization	K4	1
CO2	Analyse visualization of distributions	K4	2
CO3	Develop programs on visualization of time series, proportions & associations	K3	3
CO4	Apply visualization on Trends and uncertainty	K3	4
CO5	Explain principles of proportions	K2	5

PRE-REQUISITE	DATABASE MANAGEMENT SYSTEMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	3				2	2	3	3		3	1	
CO2			2		3		2	2	3	3	1	3		
CO3	2	3	1	1	1	2	2	2	3	3		3		3
CO4	1	2					2	2	3	3		3	2	
CO5	1		3	2	2		2	2	3	3	1	3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
UNIT- 1	**INTRODUCTION TO VISUALIZATION**	**9**
Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Colour Scales-Colour as a Tool to Distinguish, Colour to Represent Data Values ,Colour as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data		
UNIT - 2	**VISUALIZING DISTRIBUTIONS**	**9**
Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile-Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis		
UNIT - 3	**VISUALIZING ASSOCIATIONS & TIME SERIES**	**9**
Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions-Nested Proportions Gone Wrong, Mosaic Plots and Tree maps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables		
UNIT - 4	**VISUALIZING UNCERTIANITY**	**9**
Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plot		
UNIT - 5	**PRINCIPLE OF PROPORTIONAL INK**	**9**
The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Colour Use-Encoding Too Much or Irrelevant Information ,Using Nonmonotonic Colour Scales to Encode Data Values, Not Designing for Colour-Vision Deficiency		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, 1st edition, O’Reilly Media Inc, 2019.
2	Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization,O’Reilly ,2016
3	Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems,Apress, 2018

OTHER REFERENCES	
1	https://www.netquest.com/hubfs/docs/ebook-data-visualization-EN.pdf
2	https://www.coursera.org/learn/python-for-data-visualization#syllabu
3	https://www.coursera.org/learn/data-visualization

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E.,CSE	20CS6E6	CYBER CRIME AND CYBER FORENSICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Examine the concept of cybercrime in mobile devices.	K4	1
CO2	Inspect the cyber security challenges in the modern devices.	K4	2
CO3	Analyze the working principle of cyber security tools and methods.	K4	3
CO4	Apply the concept of cyber forensics to set a cyber forensics laboratory	K3	4
CO5	Discover the process of cyber security systems in the organizations.	K4	5

PRE-REQUISITE	COMPUTER NETOWRKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2				2	2	3	3		3		
CO2	1	2	2		3		2	2	3	3		3	2	
CO3	2	3	3	2			2	2	3	3		3		2
CO4	1	2	2	3			2	2	3	3		3		
CO5	1	2	3	2	3		2	2	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTIONTO CYBERCRIME**	**9**
Cybercrime- definition and origins of the world- Cybercrime and information security Classifications of cybercrime- Cybercrime and the Indian ITA 2000 - A Global Perspective on cybercrimes- Cloud Computing-Proliferation of Mobile and Wireless Devices- Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era.		
Topic - 2	**CYBER SECURITY CHALLENGES IN MODERN DEVICES**	**9**
Security Challenges Posed by Mobile Devices- Registry Settings for Mobile Devices Authentication Service Security- Attacks on Mobile/Cell Phones, Mobile Devices, - Security Implications for Organizations- Organizational Measures for Handling Mobile-Devices-Related Security Issues Organizational Security Policies and Measures in Mobile Computing Era,Laptops.		
Topic - 3	**TOOLS AND METHODS**	**9**
Tools and Methods Used in Cyber line Proxy Servers and Anonymizers- Phishing -Password Cracking, Key loggers and Spywares, - Virus and Worms, Steganography - DoSDDoS Attacks - SQL Injection, Buffer Over Flow - Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) - The Legal Perspectives - Cyberlaw: The Indian Context - The Indian IT Act.		
Topic - 4	**CYBER FORENSICS**	**9**
Understanding Computer Forensics - Historical Background of Cyber forensics - Digital Forensics Science - The Need for Computer Forensics -Cyber forensics and Digital Evidence - Forensics Analysis of Email - Digital Forensics Lifecycle - Chain of Custody Concept - Network Forensics - Approaching a Computer Forensics Investigation - Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography.		
Topic - 5	**ORGANIZATIONS IMPLICATIONS**	**9**
Organizational Implications Cost of Cybercrimes and IPR Issues: - Lesson for Organizations Web Treats for Organizations: The Evils and Perils - Security and Privacy Implications from Cloud Computing - Social Media Marketing: Security Risk and Perils for Organization - Social Computing and the Associated Challenges for Organizations - Protecting People- Privacy in the Organization, Organizational Guidelines for Internet Usage - Safe Computing Guidelines and Computer Usage Policy.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**46**

BOOK REFERENCES	
1	Nina Godbole, SunitBelapure, Cyber Security, Wiley India, New Delhi 2012
2	Harish Chander, cyber laws & IT protection, PHI learning pvt.ltd, 2012.
3	Dhiren R Patel, Information security theory &practice,PHI learning pvt ltd,2010
4	.MS.M.K.Geetha&Ms.SwapneRaman Cyber Crimes and Fraud Management, MACMILLAN,2012.
5	Pankaj Agarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.

OTHER REFERENCES	
1	https://youtu.be/xR02CQCgcNM
2	https://youtu.be/sLzGlFfbU7E
3	https://youtu.be/OkFj1ePW2cU

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. CSE B. Tech. IT	20CS6E7	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze activities, methodologies for project planning and project evaluation to develop a successful project using Cost-benefit Evaluation Techniques.	K4	1
CO2	Assess the quality of software using agile methods, extreme programming and scrum for a given project and estimate the effort and cost for software development activity using COSMIC Full function points and COCOMO II metrics.	K5	2
CO3	Apply critical path method and precedence networks for a given project to identify the critical activities that affect the target completion time.	K3	3
CO4	Explain the need for the continuous monitoring and control of a project for a given project plan to complete the project on time.	K5	4
CO5	Discuss how to manage people, ways to increase staff motivation and team working using Oldham-Hackman job characteristic model for the successful Completion of a project	K6	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2	2	3	2	2	2	3	3		3	2	
CO2		2		2	3	3	2	2	3	3		3		2
CO3	2				3		2	2	3	3		3	2	
CO4	2			2	3	2	2	2	3	3		3	2	
CO5			2			3	2	2	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**PROJECT EVALUATION AND PROJECT PLANNING**	**9**
Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Stakeholders - Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost–Benefit analysis - Evaluation techniques – Strategic program Management – Stepwise Project Planning		
Topic - 2	**PROJECT LIFE CYCLE AND EFFORT ESTIMATION**	**9**
Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM –Agile Tools: JIRA Agile - Axosoft - Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern – Case Study : Task Manager Application - Evaluation of the Cost Estimation Models.		
Topic - 3	**ACTIVITY PLANNING AND RISK MANAGEMENT**	**9**
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CPM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules. Case Study: Analyzing CPM and PERT methods for project scheduling in a construction company.		
Topic - 4	**PROJECT MANAGEMENT AND CONTROL**	**9**
Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.		
Topic - 5	**STAFFING IN SOFTWARE PROJECTS**	**9**
Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The OldhamHackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", Tata McGraw Hill, Fifth Edition, New Delhi, 2012.

OTHER REFERENCES	
1	Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.
2	Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
3	Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E.CSE	20CS6E8	SOFTWARE TESTING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the fundamentals and activities in software testing	K6	1
CO2	Explain the various test design strategies.	K6	2
CO3	Examine the levels of testing and defect classes	K4	3
CO4	Analyze the techniques in test management	K4	4
CO5	Interpret the testing and debugging policies with the types of review.	K5	5

PRE-REQUISITE	PROFESSIONAL ETHICS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	1		1		2	2	3	3		3	2	
CO2		2	2		2		2	2	3	3		3		
CO3		2	2		2		2	2	3	3		3	2	
CO4		2	2		2		2	2	3	3		3		2
CO5		1	1		1		2	2	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
UNIT - 1	**SOFTWARE TESTING FUNDAMENTALS**	**9**
Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process- The six essentials of software testing - Basic Definitions: Software Testing Principles - The role of a software tester - Origins of Defects- Defect Classes the Defect Repository		
UNIT-2	**TESTING DESIGN STRATEGIES**	**9**
Introduction to Testing Design Strategies - The Smarter Tester - Test Case Design Strategies - Black Box testing - Random Testing - Equivalence Class Partitioning - Boundary Value Analysis - Cause and error graphing and state transition testing - Error Guessing - Black-box testing and COTS - White-Box testing - Test Adequacy Criteria - Coverage and Control Flow Graphs.		
UNIT - 3	**LEVELS OF TESTING**	**9**
The Need for Levels of Testing- Unit Test - Unit Test Planning- Designing the Unit Tests. The Class as a Testable Unit - The Test Harness - Running the Unit tests and Recording results- Integration tests- Designing Integration Tests - Integration Test Planning - System Test - Types-of system testing - Regression Testing.		
UNIT - 4	**TEST MANAGEMENT**	**9**
People and organizational issues in testing - organization structures for testing teams - testing services - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - test management - test process - Reporting Test Results - The role of three groups in Test Planning and Policy Development - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group		
UNIT - 5	**TEST MEASUREMENTSAND REVIEWS**	**9**
Defining Terms - Measurements and Milestones for Controlling and Monitoring- Status Meetings- Reports and Control Issues - Criteria for Test Completion- SCM - Types of reviews - developing a review program - Components of Review Plans- Reporting review results. Testing Tools-Case Selenium, Autoit		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	S Limaye, Software Testing Principles, Techniques and Tools, McGraw Hill, 2009
2	Ilene Burnstein, Practical Software Testing, Springer International, 2003
3	Boris Beiser, Software Testing Techniques, Dreamtech press, New Delhi, 2009
4	Aditya P.Mathur, Foundations of Software Testing, Pearson Education,2008.
5	. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing , Principles and Practices, pearson Education,2008.

OTHER REFERENCES	
1	https://youtu.be/T3q6QcCQZQg
2	https://youtu.be/cDQ34z0oqnQ
3	https://youtu.be/sO8eGL6SFsA
4	https://youtu.be/sbW4RThXNL8
5	https://youtu.be/lA6qRX7ps7s

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E., CSE	20CS6LT1	COMPILER DESIGN	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the phases of compiler for a given input and write context free grammars, regular expressions for a given language using LEX tool.	K3	1
CO2	Analyze the NFA, DFA for a given regular expression using subset construction algorithm, Thompson's algorithm and Minimization algorithm.	K4	2
CO3	Construct parsing tables for a given CFG grammar using appropriate bottom up and top down parsing techniques and parse a given input string using YACC tool.	K4	3
CO4	Examine the syntax directed translation schemes for the Context Free Grammar to form an intermediate languages	K4	4
CO5	Apply suitable optimization technique and code generation algorithm for a given code snippet to generate efficient and optimized code.	K3	5

PRE-REQUISITE	DATA STRUCTURES AND ALOGORITHM

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	-	-	1	3	3	-	3	-	-
CO2	3	3	2	-	-	-	-	1	3	3	-	3	2	2
CO3	3	3	2	-	-	-	-	1	3	3	-	3	1	-
CO4	3	3	2	2	-	-	-	1	3	3	-	3	-	1
CO5	3	3	2	2	-	-	-	1	3	3	-	3	1	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO COMPILERS**	**6**
Translators - Compilation and Interpretation - Language processors - The Phases of Compiler – Errors Encountered in Different Phases- Cousins of compiler - The Grouping of Phases-Compiler Construction Tools - Need and Role of Lexical Analyzer		
Topic - 2	**LEXICAL ANALYSIS**	**6**
Specification and Recognition of Tokens -Lexical Errors - Finite automata- Regular Expression - Converting Regular Expression to DFA- Minimization of DFA - Language for Specifying Lexical Analyzers-LEX - Design of Lexical Analyzer for a sample Language		
Topic - 3	**SYNTAX ANALYSIS**	**6**
Need and Role of the Parser - Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser- Predictive Parser - Bottom up parsing-Shift Reduce Parser - LR Parser-SLR Parser.		
Topic - 4	**INTERMEDIATE CODE GENERATION**	**6**
Syntax directed Definitions-Construction of Syntax Tree - Intermediate languages-Declarations- Assignment statements - Boolean expressions- Case statements – Back patching - Procedure calls.		
Topic - 5	**CODE OPTIMIZATION AND CODE GENERATION**	**6**
Runtime Storage management - Principal Sources of Optimization - DAG - Basic Blocks and Optimization Loop Optimization-Flow Graphs - Next use Information - Issues in Design of a Code Generator - The target machine - A Simple Code Generator.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	Case Study: Description of the Syntax of the source Language(mini language) for which the compiler components are designed
2	Write a C Program to Scan and Count the number of characters, words, and lines in a file.
3	Write a C Program to implement NFAs that recognize identifiers, constants, and operators of the mini language.
4	Write a C Program to implement DFAs that recognize identifiers, constants, and operators of the mini language.
5	Design a lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces, tabs and new lines, comments etc.
6	Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
7	Design Predictive Parser for the given language
8	Design a LALR bottom up parser for the given language
9	Convert the BNF rules into Yacc form and write code to generate abstract syntax tree.
10	A program to generate machine code from the abstract syntax tree generated by the parser.
11	Write a C program to simulate lexical analyzer for validating operators.

12	Write a C program to recognize strings under 'a', 'a*b+', 'abb'.
13	Write a C program to generate machine code from abstract syntax tree generated by the parser
14	Write a C program to identify whether a given line is a comment or not.
15	Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Steven S. Muchnick, "Advanced Compiler Design and Implementation," 1st Edition, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003
2	Keith D Cooper and Linda Torczon, "Engineering a Compiler", 1st Edition, Morgan Kaufmann Publishers Elsevier Science, 2004.
3	Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", 1st Edition, PearsonEducation,2008.
4	Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles,Techniques and Tools", 2nd Edition, Pearson Education, 2007.
5	Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: ADependence-based Approach", 1st Edition, Morgan Kaufmann Publishers, 2002.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106108113/2,Principles of Compiler Design, Y.N. Srikant, IISc Bangalore
2	http://nptel.ac.in/courses/106104072/ui/Course_home-2.htm, Compiler Design ,Prof. Sanjeev K Aggarwal, IIT Kanpur
3	https://youtu.be/Qkwj65l_96I,Compiler design
4	https://en.wikipedia.org/wiki/Compiler

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. CSE	20CS6LT2	OBJECT ORIENTED ANALYSIS AND DESIGN	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Assume software design express with UML diagrams.	K4	1
CO2	Construct software applications design using OO concepts.	K3	2
CO3	Identify various scenarios based on software requirements	K3	3
CO4	Translate UML based software design into pattern based design using design patterns.	K2	4
CO5	Demonstrate the various testing methodologies for OO software.	K2	5

PRE-REQUISITE	OBJECT ORIENTED PROGRAMMING AND JAVA

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	3	2	3	3	3	-	3	2	-
CO2	3	-	-	-	2	3	2	3	3	3	-	3	-	3
CO3	-	2	2	-	-	3	2	3	3	3	-	3	3	2
CO4	3	3	-	-	-	3	2	3	3	3	-	3	-	2
CO5	-	-	-	-	2	3	2	3	3	3	-	3	2	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**UNIFIED PROCESS AND USE CASE DIAGRAMS**	6
Introduction to OOAD with OO Basics – Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases		
Topic - 2	**STATIC UML DIAGRAMS**	6
Class Diagram- Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition – Relationship between sequence diagrams and use cases – When to use Class Diagrams		
Topic - 3	**DYNAMIC AND IMPLEMENTATION UML DIAGRAMS**	6
Dynamic Diagrams – UML interaction diagrams – System sequence diagram – Collaboration diagram – When to use Communication Diagrams – State machine diagram and Modelling –When to use State Diagrams – Activity diagram – When to use activity diagrams Implementation Diagrams – UML package diagram – When to use package diagrams – Component and Deployment Diagrams – When to use Component and Deployment diagrams		
Topic - 4	**DESIGN PATTERN**	**6**
GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral – Strategy – observer –Applying GoF design patterns – Mapping design to code		
Topic - 5	**TESTING**	**6**
Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	Passport automation system
2	Exam registration and result system
3	Stock maintenance system
4	E-ticketing reservation system
5	e-book management system
6	Online course reservation system
7	Foreign trading system
8	Credit card processing
9	Payroll System
10	Student information system

11	Library management system
12	Recruitment system

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	T Grady Booch et.al.: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern -Oriented Software Architecture. A system of Patterns, Volume 1, John Wiley and Sons.2007.
3	Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013.

OTHER REFERENCES	
1	https://en.wikipedia.org/wiki/Object-oriented_analysis_and_design
2	https://onlinecourses.nptel.ac.in/noc21_cs57/preview
3	https://www.ncertbooks.guru/object-oriented-analysis-and-design-using-uml/
4	https://youtu.be/0swthCcQ-qA
5	https://youtu.be/0swthCcQ-qB

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. / B. Tech. (CSE, EEE, ECE & IT)	20PT6T1	Career Guidance - II	2	1	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the Problems logically and approach the problems in a different manner	K3	1
CO2	Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.	K5	2
CO3	Effectively communicate through verbal/oral communication and improve the listening skills	K3	3
CO4	Develop skills in ideation, innovation in algorithmic thinking, and be able to apply them in problem solving	K4	4

PRE-REQUISITE	SOFTSKILL COURSE - I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		2		
CO3			2			3			3	2		1		
CO4		3	3			2			3	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Quiz
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**LOGICAL REASONING**	**5**
LR 1: Seating Arrangement LR 2: Critical Reasoning LR 3: Coded Inequality and Condition Grouping LR 4: Cubes and Verbal Reasoning LR 5: Clocks and Calendars		
Topic - 2	**QUANTITATIVE APTITUDE**	**12**
NR 1: Simple Interest and Compound Interest NR 2: Logarithms NR 3: Permutation NR 4: Combination NR 5: Probability NR 6: Number System NR 7: HCF and LCM		
Topic - 3	**VERBAL REASONING & BUSINESSES COMMUNICATION**	**3**
VR 1: Voices & Speech, Parajumbles, Error Spotting VR 2: Reading Comprehension BS1: Effective Communication, Personal Etiquettes,Group Discussion, Resume Writing.		
Topic - 4	**TECHNICAL CODING**	**10**
TECH 1: 2D array TECH 2: String functions and functions TECH 3: structure and union, DS intro TECH 4 : Array list, linked list and it's implementation		

THEORY	**20**		**TUTORIAL**	**10**		**PRACTICAL**	**0**		**TOTAL**	**30**

BOOK REFERENCES	
1	Logical Reasoning and Data Interpretation for CAT by Nishit K. Sinha
2	Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
3	A Modern Approach To Verbal Reasoning by R S Aggarwal.
4	Computer Programming for Beginners: Fundamentals of Programming Terms and Concepts - Nathan Clark

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=4WCq6leqnHs
2	https://www.youtube.com/watch?v=tnc9ojITRg4&list=PLpyc33gOcbVA4qXMoQ5vmhefTruk5t9lt
3	https://www.youtube.com/watch?v=tWN_-ieZVZU
4	https://www.youtube.com/watch?v=HAnw168huqA
5	https://www.youtube.com/watch?v=HIj8wU_rGIU

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1		Professional Elective - IV	PE	50	50	3	0	0	3
2		Professional Elective - V	PE	50	50	3	0	0	3
3		Open Elective – III	OE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
4	20CS7LT1	Cryptography & Network Security	PC	50	50	3	0	2	4
5	20CS7LT2	Cloud Computing	PC	50	50	2	0	4	4
6	20CS7LT3	Artificial Intelligence and Machine Learning	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	100	-	0	0	6	3
Total						**16**	**0**	**16**	**24**

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E., CSE B, Tech. IT	20IT6T1	BIG DATA ANALYTICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Identify the type of data based on the characteristics of datasets, compare trivial data with big data and explain the lifecycle of data analytics for real world applications.	K2	1
CO2	Discover the storage and processing techniques for big data and apply them for a given scenario using Hadoop..	K4	2
CO3	Analyze big data using quantitative, qualitative and machine learning approaches and implement regression, clustering and classification algorithm for a given big data application.	K4	3
CO4	Compare data models and computing models used for data analytics and apply predictive modeling for processing unstructured data.	K4	4
CO5	Develop analytical models for financial services, banking and recommender systems using marketing analysis, sentiment analysis and predictive analysis	K3	5

PRE-REQUISITE	DATA BASE MANAGEMENT SYSTEM

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	3	3		2			1	3	3		3	2	2
CO4	3	2			1			1	3	3		3		
CO5	3	2	3		2			1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF BIG DATA**	**9**
Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data – Big Data Analytics Lifecycle - Enterprise Technologies and Big Data Business Intelligence. Case Study: Identifying data characteristics and types of data.		
Topic - 2	**STORING AND PROCESSING BIG DATA**	**9**
Big Data Storage Concepts: Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, CAP Theorem, ACID, BASE - Big Data Processing Concepts: Parallel Data Processing, Distributed Data Processing, Hadoop, Processing Workloads, Cluster, Processing in Batch Mode, Processing in Realtime Mode - Big Data Storage Technology: On-Disk Storage Devices, In-Memory Storage Devices..		
Topic - 3	**BIG DATA ANALYSIS**	**9**
Quantitative Analysis – Qualitative Analysis – Data Mining – Statistical Analysis – Machine Learning – Semantic Analysis – Visual Analysis – Case Study : Correlation – Regression – Time Series Plot – Clustering – Classification.		
Topic - 4	**ANALYTICS MODELS – PREDICTIVE MODELING**	**9**
Introduction – Data Models – Computing Models. Predictive Modeling for Unstructured Data: Introduction – Applications of Predictive Modeling – Featured Engineering – Pattern Mining.		
Topic - 5	**APPLICATIONS FOR BIG DATA ANALYTICS**	**9**
Big Data Analytics for Financial Services and Banking: Introduction – Customer insights and marketing analysis – Sentiment Analysis – Predictive Analytics – Model Building – Fraud detection and Risk Management – Integration of Big Data Analytics into operations. Big Data Analytics and Recommender Systems: Introduction – Background – Overview – Evaluations of Recommenders – Issues..		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	C.S.R. Prabhu, Aneesh SreevallabhChivukula, Aditya Mogadala, Rohit Ghosh, L.M. Jenila, “Big Data Analytics: Systems, Algorithms, Applications”, First edition, Springer, 2019.
2	Paul Buhler, Wajid Khattak, Thomas Erl, “Big Data Fundamentals: Concepts, Drivers & Techniques”, Second Edition, Prentice Hall, 2016.
3	Anil Maheshwari, “Data Analytics” , First Edition, Tata Mcgraw Hill, 2017.
4	Venkat Ankam, “Big Data Analytics”, First Edition, Packt Publishing Limited, 2016.
5	Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, First Edition, Wiley, 2015.

OTHER REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc16_mg06, “Introduction to Data Analytics”, Dr. Nandan Sudarsanam, Dr. Balaraman Ravindran, IIT- Madras
2	https://nptel.ac.in/courses/106104135/48, “Big Data”, Prof.ArnabBhattaacharya, IIT-Kanpur.
3	https://lecturenotes.in/subject/884/big-data-analysis-bda/note
4	https://www.youtube.com/watch?v=pkPdhznqEI4

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. CSE & ECE B.Tech. IT	20ECCE2	WIRELESS AD HOC AND SENSOR NETWORKS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Outline the fundamentals of wireless communication technology that facilitate the insight of infrastructure less networks formation, application and design issues of the given Ad hoc and Sensor networks.	K2	1
CO2	Describe the MAC Protocol designing issues and contention–based algorithms with reservation and scheduling to achieve node mobility, time synchronization, bandwidth efficiency and QoS support for the given Ad hoc wireless network.	K2	2
CO3	Explain the issues behind the routing protocol blueprint and classification in transport layer to suit with Ad hoc Wireless Network.	K2	3
CO4	Divide the MAC layer protocols to emphasize the energy efficient operation, efficient neighbor discovery and channel assignment operations for the Wireless sensor networks	K4	4
CO5	Discover the architecture, data handling and localization techniques to optimize the location discovery of sensor nodes for the given wireless sensor networks.	K4	5

PRE-REQUISITE	COMPUTER NETWORKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3					1	3	3		3		
CO2	3	2	3					1	3	3		3		
CO3	3	2						1	3	3		3		
CO4	3				2			1	3	3		3		2
CO5	3		2		2			1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**TUNING TO SENSOR NETWORKS FUNDAMENTALS**	**9**
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the wireless channel – Mobile Ad hoc Networks (MANETs) and Wireless Sensor networks (WSNs): concepts and architectures – Applications of Ad Hoc and Sensor networks – Design Challenges in Ad hoc and Sensor Networks.		
Topic - 2	**MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS**	**9**
Issues in designing a MAC Protocol – Classification of MAC Protocols – Contention based protocols – Contention based protocols with Reservation Mechanisms – Contention based protocols with Scheduling Mechanisms – Multi channel MAC – IEEE 802.11.		
Topic - 3	**ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS**	**9**
Issues in designing a routing and Transport Layer protocol for Ad hoc networks – proactive routing, reactive routing (on – demand), hybrid routing – Classification of Transport Layer solutions – TCP over Ad hoc networks..		
Topic - 4	**WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS**	**9**
. Issues in designing a routing and Transport Layer protocol for Ad hoc networks – proactive routing, reactive routing (on – demand), hybrid routing – Classification of Transport Layer solutions – TCP over Ad hoc networks.		
Topic - 5	**WSN ROUTING, LOCALIZATION & QOS**	**9**
Issues in WSN routing – OLSR – Localization – Indoor and Sensor Network Localization – absolute and relative localization, triangulation – QOS in WSN – Energy Efficient Design – Synchronization – Transport Layer Issues – Case study: WBAN revisited.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2	Feng Zhao and LeonidesGuibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
3	Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005..
4	Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.
5	C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference,First Edition,2008.

OTHER REFERENCES	
1	http://nptel/courses/video/106105160/, “Medium Access Control in Wireless Networks”, Prof Sudip Misra, IIT - Kharagpur
2	https://nptel.ac.in/courses/106105160/, “Introduction: Wireless Ad Hoc Networks”, Prof Sudip Misra, IIT - Kharagpur
3	https://www.smartzworld.com/notes/adhoc-sensor-networks-notes-pdf-asn/
4	https://www.youtube.com/watch?v=ycaz99NogS4

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E., CSE	20CS7E3	THEORY OF COMPUTATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the language hierarchy using formal proofs	K4	1
CO2	Construct automata for any given pattern and find its equivalent regular expressions	K3	2
CO3	Construct a context free grammar for any given language	K3	3
CO4	Solve the Turing machines and their capability	K3	4
CO5	Examine the undesirable problems and NP class problems	K4	5

PRE-REQUISITE	COMPILER DESIGN

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		
CO2	3	3	2		2			1	3	3		3		
CO3	3	3	3		3			1	3	3		3		
CO4	3	3	2					1	3	3		3		
CO5	3	3	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**AUTOMATA FUNDAMENTALS**	**9**
Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions		
Topic - 2	**REGULAR EXPRESSIONS AND LANGUAGES**	**9**
Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata		
Topic - 3	**CONTEXT FREE GRAMMER AND LANGUAGES**	**9**
CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.		
Topic - 4	**PROPERTIES OF CONTEXT FREE LANGUAGES**	**9**
Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM.		
Topic - 5	**UNDECIDABILITY**	**9**
Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem, The Class P and NP.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	H.R.Lewis and C.H.Papadimitriou, ―Elements of the theory of Computation, Second Edition, PHI, 2003.
2	J.Martin, ―Introduction to Languages and the Theory of Computation, Third Edition, TMH, 2003.
3	Micheal Sipser, ―Introduction of the Theory and Computation, Thomson Brokecole, 1997.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=qqTRszXq_LM
2	https://youtu.be/iKtCewwhjN4
3	https://en.wikipedia.org/wiki/Total_organic_carbon
4	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/total-organic-carbon
5	https://www.shimadzu.com/an/products/total-organic-carbon-analysis/toc-analysis/toc-l-seriEL

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E., CSE	20CS7E4	MOBILE COMPUTING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the mobile application for the given user requirement using android development framework and tools.	K3	1
CO2	Build the android applications using views, layouts, intents and SMS Manager API to send SMS and E-mails.	K3	2
CO3	Analyze the menu, notifications and multimedia features for the applications using android Notification Manager and Multimedia APIs.	K4	3
CO4	Examine databases for the applications to store and retrieve data using SQLite and Firebase.	K4	4
CO5	Categorize the mobile applications using standard Mobile Device Operating Systems0	K3	5

PRE-REQUISITE	COMPUTER NETWORKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		3			1	3	3		3		
CO2	3	3	2					1	3	3		3		
CO3	3	3	2					1	3	3		3		
CO4	3	3	2					1	3	3		3		
CO5	3	3	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Introduction to Mobile Computing — Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing — Spread spectrum -MAC Protocols — SDMA- TDMA- FDMA- CDMA		
Topic - 2	**MOBILE TELECOMMUNICATION SYSTEM**	**9**
Introduction to Cellular Systems — GSM — Services & Architecture — Protocols — Connection Establishment — Frequency Allocation — Routing — Mobility Management — Security — GPRS- UMTS — Architecture — Handover — Security		
Topic - 3	**MOBILE NETWORK LAYER**	**9**
Mobile IP — DHCP — AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols — DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET — Security.		
Topic - 4	**MOBILE TRANSPORT AND APPLICATION LAYER**	**9**
Mobile TCP– WAP — Architecture — WDP — WTLS — WTP –WSP — WAE — WTA Architecture — WML		
Topic - 5	**MOBILE PLATFORMS AND APPLICATION**	**9**
Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	Reto Meier, “Professional Android 4 Application Development”, Wiley India Pvt. Ltd, New Delhi - 2014.
2	John M. Wargo, “Apache Cordova API Cookbook”, Pearson Education – 2015.
3	ZiguardMedneiks, Laird Dornin G, Blake Meike and Masumi Nakamura, “Programming Android”, O’Reily,2013.
4	Anubhav Pradhan and Anil V Deshpande, “Composing Mobile Apps”, First Edition, Wiley India Pvt. Ltd, 2014.
5	Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, Manning Publications, 2012.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106/106/106106147/, “Mobile Computing – Starting Android Programming”, Professor Pushpendra Singh, IIT- Madras
2	https://nptel.ac.in/courses/106/106/106106222/, “Introduction to Modern Application Development”, Prof. Madhavan Mukund, Prof. AbhijatVichare and Prof. Aamod Sane, IIT- Madras.
3	https://www.youtube.com/watch?v=5kBknJWi71Q&list=PLrjkTql3jnm-kLRBgIt8kvuwbTScoI2IJ
4	https://www.youtube.com/watch?v=GT-tYP8RGIs&list=PLV8vIYTIdSnZMKTQSTxWbx4NGNfxyZq_N

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E., CSE	20CS7E5	DEEP LEARNING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the working of Unsupervised Learning and Supervised Learning Neural Network.	K2	1
CO2	Apply Regression and Classification predictive models for function approximation.	K3	2
CO3	Apply the Probability theory a mathematical framework for representing uncertain statements	K3	3
CO4	Analyze and Design the Convolutional Neural Network models to recognize, model, and solve problems in the analysis and design of information systems.	K4	4
CO5	Apply the Recurrent Neural Network models to recognize, model, and solve problems in the analysis and design of information systems.	K3	5

PRE-REQUISITE	INTERNET OF THINGS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2		2	2	3	3		3		
CO2	3	2			2		2	2	3	3		3		
CO3	3	2			2		2	2	3	3		3		
CO4	3	3			3		2	2	3	3		3		2
CO5	3	2			2		2	2	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**NEURAL NETWORKS**	**9**
Neural Network- Multilayer neural networks-Unsupervised Learning-Supervised Learning- Boltzmann Machine-Optimization using Hopfield Network- Genetic Algorithm- Applications of Neural Networks.		
Topic - 2	**AI AND MACHINE LEARNING**	**9**
Intelligent agents, Agents and environments, Structure of agents - Problem Solving - Problem solving agent-Machine Learning-Supervised and Unsupervised learning-Regression and Classification-K-Means Clustering.		
Topic - 3	**DEEP LEARNING TECHNIQUES**	**9**
Introduction-History of Deep Learning-Linear Model Regression-Deep Learning Working-PerceptronBack Propagation-Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models.		
Topic - 4	**CONVOLUTIONAL NEURAL NETWORK**	**9**
. Convolutional Neural Network-Architecture- Back propagation- ConvNets for spatial localization-Object detection.		
Topic - 5	**RECURRENT NEURAL NETWORK**	**9**
Recurrent Neural Networks (RNN)-Long Short Term Memory (LSTM)-RNN language models-Image captioning.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book (2015).
2	Mishra R B, Artificial Intelligence, PHI Learning Pvt. Ltd., New Delhi, 2011
3	Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.
4	Kevin Knight, Elaine Rich and Nair, Artificial Intelligence, Tata McGraw Hill, New Delhi, 2008
5	Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.

OTHER REFERENCES	
1	https://www.techtarget.com/searchenterpriseai/definition/deep-learning-deep-neural-network
2	https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwifqu3Wj7H3AhU3lGYC
3	https://www.youtube.com/watch?v=VyWAvY2CF9c
4	https://www.youtube.com/watch?v=O5xeyoRL95U

Semester	Programme	Course Code	Course Name	L	T	P	C
VIII	B.E., CSE	20CS7E6	CRYPTO CURRENCY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Discover the secure and efficient transactions with cryptocurrencies and blockchain	K4	1
CO2	Experiment with crypto currency trading and crypto exchanges	K3	2
CO3	Assume the core components of Bitcoin Network with the necessary scriplets.	K4	3
CO4	Develop private block chain environment and develop a smart contracton Ethereum	K3	4
CO5	Build the hyper ledger architecture and the consensus mechanism applied in the hyper ledger	K3	5

PRE-REQUISITE	WEB TECHNOLOGY

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2	2	3	3		3		
CO2	3						2	2	3	3		3		
CO3	3						2	2	3	3		3		
CO4	3						2	2	3	3		3		
CO5	3						2	2	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT											
Topic - 1	**. CRYPTOCURRENCY AND BLOCKCHAIN- INTRODUCTION**										**9**
Block chain- An Introduction, Distinction between databases and block chain, Distributed ledger. Block chain ecosystem - Consensus Algorithms & Types, Block chain structure, Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain Digital Disruption in Industries – Banking, Insurance, Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains											
Topic - 2	**. CRYPTO CURRENCIES**										**9**
Crypto Currencies - Anonymity and Pseudonymity in Cryptocurrencies - Digital Signatures - Cryptocurrency Hash Codes -Need for Crypto Currencies – Crypto Markets – Explore Crypto Currency Ecosystems - ICOs – Crypto Tokens - Atomic Swaps – Crypto Currency Exchanges – Centralised and Decentralized Crypto exchanges – Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks.											
Topic - 3	**BITCOIN**										**9**
History of Money – Dawn of Bitcoin – The Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full Nodes vs SPVs – Bitcoin Wallet.											
Topic - 4	**. ETHEREUM**										**9**
The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- differentstages of a contract deployment- Viewing Information about blocks in Blockchain- Developing smart contract on private Blockchain- Deploying contract from web and console											
Topic - 5	**HYPERLEDGER**										**9**
Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers- Application programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Blockchain network- Creating and Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants											
THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**	

BOOK REFERENCES	
1	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos2018.
2	Henning Diedrich, Ethereum: Block chains, Digital Assets, Smart Contracts,Decentralized Autonomous Organizations-2016.
3	William Mougayar, “The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology”, Wiley Edition, 2016.
4	Imran Bashir, Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained, 2nd Edition, Pockt Publishing,2016
5	Neil Hoffman, Gary McAllen, “Blockchain: Everything You Need to Know About Blockchain Technology and How It Works” – Amazon Kindle Edition.

OTHER REFERENCES	
1	ps://www.coursera.org/learn/ibm-blockchain-essentials-for-developers
2	https://museblockchain.com/
3	https://www.youtube.com/watch?v=1YyAzVmP9xQ
4	https://www.coursera.org/learn/blockchain-basics https://steemit.com/

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E., CSE	20CS7E7	DISTRIBUTED SYSTEMS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Discover resource sharing principles, trends and challenges in a distributed system using World Wide Web as a case study...	K4	1
CO2	Illustrate process communication using remote method invocation for a given distributed environment.	K2	2
CO3	Describe the file systems for a distributed environment using distributed file service implementations.	K2	3
CO4	Apply suitable concurrency control method to ensure multiple transactions to maintain ACID property and serializability in the schedules.	K3	4
CO5	Explain process and resource management policies for a given distributed environment using scheduling algorithms	K2	5

PRE-REQUISITE	WEB TECHNOLOGY

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2	2	3	3		3		
CO2	3		3		2		2	2	3	3		3		
CO3	3						2	2	3	3		3		
CO4	3		3		2		2	2	3	3		3		
CO5	3						2	2	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web- System models-Physical model-Architectural model-Fundamental model.		
Topic - 2	**COMMUNICATION IN DISTRIBUTED SYSTEM**	**9**
Inter process Communication - the API for internet protocols – External data representation and marshallingRemote Invocation – Request-reply protocols - Remote procedure call - Remote method invocation. Case study: Java RMI – Group communication - Publish-subscribe systems - Message queues - Shared memory approaches.		
Topic - 3	**DISTRIBUTED FILE SYSTEM AND NAME SERVICES**	**9**
Distributed File Systems –Introduction – File service architecture – Andrew File system. Case study: Google File system. Naming - Introduction-Name services and domain name system-Directory Services-Peer to peer Systems-Napster-Peer to peer middleware- Routing overlays.		
Topic - 4	**DISTRIBUTED TRANSACTIONS AND CONCURRENCY CONTROL**	**9**
. Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks– Coordination and Agreement – Introduction - Distributed mutual exclusion algorithms – Election algorithms – Distributed Transactions– Flat and nested distributed transactions-Atomic Commit protocols – Concurrency control in Distributed systems- Distributed deadlocks-Transaction Recovery.		
Topic - 5	**PROCESS & RESOURCE MANAGEMENT**	**9**
Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2	Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2012
3	Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2012.

OTHER REFERENCES	
1	. https://nptel.ac.in/courses/106106107/, “Inter process Communication”, Prof. Ananthanarayana VS, Department of Information Technology, NITK ,Surathkal.
2	https://onlinecourses.nptel.ac.in/, ”Time and global states”, Dr. Rajiv Misra, Department of Computer Science and Engineering, IIT, Patna.
3	Tanenbaum A.S., Van Steen M., ―Distributed Systems: Principles and Paradigms‖, Pearson Education, 2007.
4	Nancy A Lynch, ―Distributed Algorithms‖, Morgan Kaufman Publishers, USA, 2003.

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E CSE	20CS7LT1	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	2	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the basic concepts of network security	K4	1
CO2	Identify the types of symmetric ciphers and its principles	K3	2
CO3	Classify the types of Asymmetric ciphers and its principles	K2	3
CO4	Develop Algorithms for data integration	K3	4
CO5	Explain the privacy issues and Use the procedures in internet security	K2	5

PRE-REQUISITE	COMPUTER NETWORKS, WEB TECHNOLOGY

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3							1	3	3		3		3
CO2	3	2	3	3				1	3	3		3	3	2
CO3	3	2	2	2				1	3	3		3		
CO4	3	3	3	3				1	3	3		3	2	2
CO5	3	3	2			3		1	3	3		3	3	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Computer security concepts - OSI security architecture - security attacks service mechanism - model for network security – classical encryption techniques – Block cipher principles		
Topic - 2	**SYMMETRIC CIPHERS**	**9**
Data encryption standard – block cipher operations – cipher block chaining mode – advanced encryption standard – double DES – triple DES – round function – key expansion		
Topic - 3	**ASYMMETRIC CIPHERS AND KEY MANAGEMENT**	**9**
Primary numbers – testing for primality – public key cryptography RSA – distribution of public keys –key management and distribution – public key infrastructure – symmetric key distribution using asymmetric encryption-Block cipher operation-electronic code book		
Topic - 4	**CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS**	**9**
Cryptographic hash functions – application – two simple hash functions – requirements and security hash functions based on cipher block chaining –secure hash algorithm (SHA) – SHA – 3 – message authentication codes-Digital principle and authentication protocols.		
Topic - 5	**NETWORK AND INTERNET SECURITY**	**9**
Transport level security – web security issues – secure socket layer (SSL) – transport layer security (TLS) – HTTPS – Secure shell – pretty good privacy (PGP) – firewalls – IP security-E commerce		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

LIST OF EXPERIMENTS	
1	Implement the following Substitution & Transposition Techniques a) Caesar Cipher b) Playfair Cipher c) Hill Cipher
2	Implement the following algorithms a) DES b) RSA Algorithm c) Diffiee-Hellman d) MD5 e) SHA-1

3	Implement the Signature Scheme - Digital Signature Standard
4	Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5	Setup a honey pot and monitor the honeypot on network (KF Sensor)
6	Installation of rootkits and study about the variety of options
7	Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler)
8	Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)
9	Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
10	Defeating Malware: i. Building Trojans ii. Rootkit Hunter

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**30**		**TOTAL**	**30**

BOOK REFERENCES	
1	William Stallings, Cryptography and Network security Principles and Practices, 5th edition, Pearson Education, 2010
2	William Stallings, Network security essentials Ã¢?? application and standards, Prentice Hall of India , 2010
3	Charles P.Fleeger, Shari Lawrence P.Fleeger, Security in computing, Prentice Hall of India, 2009
4	W. Mao, Modern Cryptography Ã¢?? Theory and Practice, Pearson Education, 2007
5	Wade Trappe, Lawrence C Washington, Introduction to Cryptography with coding theory, Pearson Education, 2007

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1	https://www.notesforgeeks.in/2021/07/cs8792-cryptography-and-network-security-syllabus-2017-regulation.html
2	https://www.studocu.com/in/document/anna-university/cryptography-and-network-security/cs8792-cryptography-and-network-security/8876690
3	https://cse-r17.blogspot.com/2020/09/cs8792-cryptography-and-network.html
4	https://padeepz.net/cs6701-syllabus-cryptography-and-network-security-regulation-2013-anna-university/
5	https://www.rejinpaul.com/2016/07/cs6701-cryptography-and-network-security-syllabus-notes-question-bank-with-answers.html

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E.CSE	20CS7LT2	CLOUD COMPUTING	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the main concepts, key technologies, strengths and limitations of cloud computing.	K4	1
CO2	Apply the key and enabling technologies that help in the development of cloud.	K3	2
CO3	Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.	K3	3
CO4	Inference the core issues of cloud computing such as resource management and security.	K4	4
CO5	Assume the emergence of cloud as the next generation computing paradigm.	K4	5

PRE-REQUISITE	COMPUTER NETWORKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					3	2	3	3	3	3	3		3
CO2	3	2	3	3		3	2	3	3	3	3	3	3	2
CO3	3	2	2	2		3	2	3	3	3	3	3		
CO4	3	3	3	3		3	2	3	3	3	3	3	2	2
CO5	3	3	2			3	2	3	3	3	3	3	3	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini project & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	6
Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – Ondemand Provisioning.		
Topic - 2	**CLOUD ENABLING TECHNOLOGIES**	6
Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.		
Topic - 3	**CLOUD ARCHITECTURE, SERVICES AND STORAGE**	**6**
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.		
Topic - 4	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD**	**6**
Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-asa-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.		
Topic - 5	**CLOUD TECHNOLOGIES AND ADVANCEMENTS**	**6**
Hadoop – Map Reduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3	Install Google App Engine.
4	Use GAE to Create hello world app and other simple web applications using python/java.
5	Use GAE launcher to launch the web applications.

6	Simulate a cloud scenario using CloudSim
7	Simulate a cloud scenario and run a scheduling algorithm that is not present in CloudSim.
8	Find a procedure to transfer the files from one virtual machine to another virtual machine.
9	Install Openstack
10	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
11	Install Hadoop single node cluster
12	Use Hadoop to run simple applications like word count.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012
2	Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy
3	Enterprise Perspective on Risks and Compliance", O'Reilly 2009
4	Bernard Golden, "Amazon Web Services for Dummies", John Wiley & Sons, 2013.
5	Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, Wiley publishing, Inc. 2011

OTHER REFERENCES	
1	https://easyexamnotes.com/p/cloud-computing
2	https://gomindsight.com/ cloud-computing
3	https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/
4	https://www.investopedia.com/terms/c/cloud-computing.asp
5	https://www.javatpoint.com/cloud-computing-tutorial

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. CSE	20CS7LT3	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Categorize the different types of problem solving agents and solve problems using informed and uninformed search strategies	K4	1
CO2	Apply the foundational concepts in machine learning	K3	2
CO3	Construct algorithms for learning the linear and non-linear models	K3	3
CO4	Develop the usage of various data clustering algorithms	K3	4
CO5	Analyse the learning algorithms for tree and rule-based models	K4	5

PRE-REQUISITE	INTERNET OF THINGS , SOFTWARE ENGINEERING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			3	3		2		3	3		3		
CO2	3		3	3			2		3	3		3		
CO3	3	2		3			2		3	3		3		
CO4	3			3	2		2		3	3		3	3	
CO5	3		2	3	3		2		3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**6**
Intelligent Agents - Agents and environments - The foundations of AI - The History of AI- Intelligent agents- Agent based system Problem Solving: Searching for solution- Uninformed/Blind search - Informed/ Heuristic search - A* search. Knowledge Representation And Reasoning: Logics – First order logic, Inference in first order logic, Knowledge representation Planning: The planning problem - Planning with state space search - Planning and acting in the real world.		
Topic - 2	**MACHINE LEARNING**	**6**
The Fundamentals of Machine Learning - The Machine Learning Landscape - Main Challenges of Machine Learning - End-to-End Machine Learning Project Working with Real Data - Discover and Visualize the Data to Gain Insights - Prepare the Data for Machine Learning Algorithms		
Topic - 3	**CLASSIFICATION & PLANNING**	**6**
Classification - Training a Binary Classifier - Performance Measures - Multiclass Classification - Training Models - Linear Regression - Gradient Descent - Polynomial Regression - Regularized Linear Models, Planning with state space search - Partial order planning - Planning graphs		
Topic - 4	**VECTOR MACHINES & DECISION TREE**	**6**
Support Vector Machines - Linear SVM Classification - Nonlinear SVM Classification - SVM Regression - Decision Trees - Training and Visualizing a Decision Tree - Making Predictions - The CART Training Algorithm - Regularization Hyper parameters		
Topic - 5	**LEARNING AND RANDOM FORESTS**	**6**
Voting Classifiers - Bagging and Pasting- Random Patches and Random Subspaces - Random Forests – Boosting - Dimensionality Reduction – PCA - Kernel PCA - Up and Running with Tensor Flow - Distributing Tensor, Flow Across Devices and Servers		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	To implement A* Algorithm
2	To implement AO* Algorithm
3	To implement the Backtracking approach to solve N Queen's problem
4	To implement Min-Max Algorithm
5	To implement Breadth First Search
6	To implement Depth First Search
7	To implement for IDA* (Iterative Deepening A*) algorithm
8	To implement K-Nearest Neighbor Algorithm for data classification , choose dataset of your own choice.

9	To implement Naïve Bayes Algorithm for data classification , choose dataset of your own choice
10	To implement Support Vector Machines for data classification , choose dataset of your own choice
11	To implement Artificial Neural Network for data classification , choose dataset of your own choice
12	To implement Logistic Regression for data classification , choose dataset of your own choice

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Stuart Russel, Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3/e, Prentice hall,2009.
2	Ethem Alpaydin, “Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)”, 3/e, MIT Press, 2014
3	Jason Bell, “Machine learning – Hands on for Developers and Technical Professionals”, 1/e, Wiley, 2014
4	Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, 1/e, Cambridge University Press, 2012.
5	K. P. Murphy, “Machine learning: A probabilistic perspective”, MIT Press, 2012.

OTHER REFERENCES	
1	https://marutitech.com/artificial-intelligence-and-machine-learning/
2	https://www.sas.com/en_us/insights/articles/big-data/artificial-intelligence-machine-learning-deep-learning-and-beyond.html
3	https://azure.microsoft.com/en-in/overview/artificial-intelligence-ai-vs-machine-learning/
4	https://ai.engineering.columbia.edu/ai-vs-machine-learning/
5	https://cloud.google.com/training/machinelearning-ai

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. CSE	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Intelligent Systems Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Utilize an writing tool in AI for paraphrasing and text manipulations
2	Demonstrate an image generator AI tool to induce the user creativity
3	Construct an Art tool in AI for inducing the user creativity
4	Implement an Logo generator tool in AI for various logo creations
5	Apply a website developing AI tool for creating an appealing website for a customer:
6	Implement any SEO Tool to create a beneficial blog for the viewers
7	Analyze Breadth First Search using PYTHON program(BFS)
8	Develop a PYTHON program to implement Depth First Search (DFS)
9	Implement Backtracking Search using PYTHON program
10	Create a PYTHON program for job scheduling
11	Create a Video by using video generator AI tool
12	Implement a productivity AI tool for mind mapping brain storming and work flows by using GIT mind AI

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	Intelligent Systems Laboratory Manual, Al-Ameen Publications, 2020
2	https://onlinelibrary.wiley.com/toc/26404567/2022/4/4

OTHER REFERENCES	
1	https://www.iitk.ac.in/ee/intelligent-systems-laboratory
2	https://mksaad.wordpress.com/2019/02/05/artificial-intelligence/
3	https://mrcet.com/LaboratoryManuals.html

SEMESTER VIII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
LABORATORY COURSES									
1	20CS8L1	Project Work	EEC	50	50	0	0	20	10
2	20CS8L2	Industrial Training / Internship	EEC	100	-	4 Weeks			3
Total						**0**	**0**	**20**	**13**

OPEN ELECTIVES (OE) OFFERED BY THE DEPARTMENT

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20CSO01	Object Oriented Programming Using Java	3	0	0	3
2.	20CSO02	Computer Architecture	3	0	0	3
3.	20CSO03	Data Structures	3	0	0	3
4.	20CSO04	Operating Systems	3	0	0	3
5	20CSCT5	Python Programming	3	0	0	3
6	20CSO06	Cloud Computing	3	0	0	3
7	20CSO07	Artificial Intelligence	3	0	0	3
8	20IT6T1	Big Data Analytics	3	0	0	3
9	20CSO09	Internet of Things	3	0	0	3

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO01	OBJECT ORIENTED PROGRAMMING USING JAVA	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Apply a Java program for the given problem statement using operator, arrays, classes and methods.	K3	1
CO2	Develop solution for a given problem using Inheritance and Packages to achieve reusability and implement exception handling code to handle the run time errors.	K3	2
CO3	Inspect a Java code for the given problem statement using String handling functions and I/O streams.	K4	3
CO4	Compare an applet for a given scenario to embed dynamic content in the web page	K4	4
CO5	Apply a simple GUI application for a given scenario using AWT components and to access the backend Database using JDBC.	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		1	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			1	1	3	3		3	2	2
CO5	1	2	3		3		1	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**OVERVIEW OF JAVA**	**9**
Concepts of Object Oriented Programming – An Overview of Java – Data types, Variables and Arrays – Operators – Control statements – Classes – Methods.		
Topic - 2	**INHERITANCE AND EXCEPTION HANDLING**	**9**
Inheritance: Basics – Super keyword – Method Overriding – Dynamic Method dispatch – Abstract classes – final keyword. Packages and Interfaces: Packages – Access protection – Importing Packages – Interfaces - Exception Handling		
Topic - 3	**STRING HANDLING AND I/O**	**9**
Multithreading - String Handling: String Constructors – Special String Operations – Character Extraction – String comparison – Searching and Modifying a String – String Buffer – String Tokenizer. Input/Output: The Stream Classes – The Byte Streams – The Character Streams – Serialization..		
Topic - 4	**COLLECTIONS**	**9**
Collections: List – Array List – Set – Hash Set – Tree Set- Queue – Priority Queue - Map – Hash Map – Iterator – Enumerator- Wrapper Classes- Auto boxing and Un boxing- Regular Expressions.		
Topic - 5	**STREAM API AND JDBC**	**9**
Lambda Expression – Lambda Parameters - Functional Interfaces - Creating Thread- Stream API – Creating Java streams - Intermediate Operations: map – filter – sort – Terminal Operations: Collect – reduce – for each - try with resources. Java Database Connectivity - Manipulating Databases with JDBC.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Herbert Schildt, “Java - The Complete Reference”, Ninth Edition, McGraw-Hill Education, 2014.
2	Rajkumar Buyya, S Thamarai Selvi, Xingchen Chu, “Object Oriented Programming with Java – Essentials and Applications”, McGraw-Hill Education, 2009..
3	Paul Deitel, Harvey Deitel, “Java How to Program”, Prentice Hall, Tenth Edition, 2014
4	Kathy Sierra, Bert Bates, “Head First Java”, Second Edition, O'Reilly Media, 2005..
5	“Java 6 Programming Black Book”, Kogent Learning Solutions Inc.,2007.

OTHER REFERENCES	
1	http://www.nptelvideos.com/video.php?id=1471&c=15
2	http://nptel.ac.in/courses/106105084/30,Java Programming, Prof. Indranil Sengupta, IIT kharagpur

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO02	COMPUTER ARCHITECTURE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Analyze the performance and describe the instruction set using different addressing modes for a given computer architecture and organization.	K4	1
CO2	Develop the arithmetic operations involving addition, subtraction, division, multiplication and floating point number operations for a given computer organization.	K3	2
CO3	Classify the data path and describe the effect of data hazard, control hazard for a given pipeline processor.	K4	3
CO4	Apply the memory hierarchy and analyze the operation of cache memory for a given computer organization	K3	4
CO5	Compare the standard I/O interfaces and data transfer techniques to access I/O devices for the given computer system.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		1	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			1	1	3	3		3	2	2
CO5	1	2	3		3		1	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**BASIC STRUCTURE OF COMPUTERS**	**9**
Functional Units – Basic Operational Concepts– Bus Structures - Instruction Set Architecture–RISC – CISC – Instructions and Instruction Sequencing– Addressing modes– Performance and Metrics.		
Topic - 2	**ARITHMETIC OPERATIONS**	**9**
Addition and Subtraction – Design of Fast Adders – Signed operand Multiplication – Fast Multiplication - Integer Division – Floating Point Numbers and Operations		
Topic - 3	**PROCESSOR AND CONTROL UNIT**	**9**
Basic concepts –Role of Cache Memory – Pipelining Performance – Types of Hazards- Data hazards – Instruction Hazards (prediction) – Data path and Control Considerations.		
Topic - 4	**MEMORY SYSTEMS**	**9**
Memory hierarchy – Speed , Size and Cost – Semiconductor RAM – ROM–Cache Memory – Mapping FUNCTIONS – Replacement Algorithms – Measuring Cache Performance.		
Topic - 5	**I/O ORGANIZATION**	**9**
Accessing I/O devices – Programmed Input / Output – Interrupts – Direct Memory Access –Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	V.CarlHamacher, ZvonkoVaranesic and SafwatZaky, “Computer Organization“, 5 thEdition, McGraw-Hill Inc, 2012.
2	David A. Patterson and John L. Hennessey, “Computer organization and design“, Morgan Kauffman/ Elsevier, 5 th Edition, 2014.
3	M. Morris Mano, “Computer System Architecture”, 3rd Edition Pearson Education, 2017
4	William Stallings “Computer Organization and Architecture”, 10th Edition, Pearson Education, 2015.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106102062/1, “Computer Architecture”, Prof. Anshul Kumar, IIT- Delhi. .
2	http://nptel.ac.in/courses/106105084/30,Java Programming,Prof. Indranil Sengupta, IIT kharagpur

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO03	DATA STRUCTURES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	List ADT for a given list or table using array and linked list implementation by ensuring the ordering of data elements.	K4	1
CO2	Develop stack and queue ADT for a given list using array and linked list implementation and apply specific ADT for a given application	K3	2
CO3	Examine a tree for a given list of data by ensuring tree properties and analyze inorder, preorder, postorder traversal for a constructed tree.	K4	3
CO4	Discover a suitable shortest path algorithm for a given graph such that the sum of the edges weights is minimum.	K4	4
CO5	Apply a suitable searching and hashing algorithms for a given list of data considering the size and ordering of data.	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		1	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			1	1	3	3		3	2	2
CO5	1	2	3		3		1	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**LISTS**	**9**
Abstract Data Types (ADT) – List ADT – Array-Based Implementation – Linked List Implementation– Singly Linked Lists- Circularly Linked Lists -Doubly-Linked Lists – Applications of Lists...		
Topic - 2	**STACKS AND QUEUES**	**9**
Stack ADT – Queue ADT – Circular Queue – Applications of Stacks and Queues.		
Topic - 3	**TREES**	**9**
Preliminaries - Binary Trees - Binary Tree Traversal - Binary Search Trees- Expression Trees - AVL Trees- Binary Heap - Heap Sort		
Topic - 4	**GRAPHS**	**9**
Definitions–Graph Traversal- Topological Sort– Shortest-Path Algorithms: Unweighted Shortest PathsDijikstra's Algorithm– Minimum Spanning Tree– Prim's and Kruskal's Algorithms– Undirected Graphs		
Topic - 5	**SEARCHING AND HASHING**	**9**
Searching: Linear Search – Binary Search. Hashing – General idea-Hash Function- Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing- Double Hashing.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2015..
2	Richard F. Gilberg, and Behrouz A. Forouzan, "Data Structures - A Pseudocode Approach with C", Second Edition, Thomson Brooks/cole, 2011.
3	Reema Thareja, "Data Structures Using C", First Edition,Oxford University Press, 2011
4	ISRD Group, "Data Structures Using C", First Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2007.
5	" Data Structures through C, Yashwant Kanetkar, BPB Publications.

OTHER REFERENCES	
1	http://www.nptel.ac.in/courses/106102064, Introduction to data structure, Mr.Varma, IIT Bombay
2	http://nptel.ac.in/courses/106102064, Video Lectures, Data Structures and Algorithms, IIT Delhi.

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO04	OPERATING SYSTEM	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Construct the structure and functions of Operating Systems for multiuser environment considering Linux process and thread management as a case study.	K3	1
CO2	Evaluate the process scheduling algorithms for a given set of process considering the arrival time, burst time and resources	K5	2
CO3	Analyze the memory allocation techniques and page replacement algorithms for a given reference strings with minimum page fault..	K4	3
CO4	Analyze file allocation methods for efficient file organization considering Linux virtual file system as a case study.	K4	4
CO5	Examine the disk scheduling algorithms with minimum seek time for a given disk request and analyze the architecture of iOS and Android Mobile Operating Systems.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1					1	3	3		3		1
CO2		3		3			1	1	3	3	1	3	2	
CO3			2		3		1	1	3	3		3		3
CO4	2					2		1	3	3	2	3	2	
CO5		1					1	1	3	3	3	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	OPERATING SYSTEMS AND PROCESS MANAGEMENT	**9**
Operating System Overview: Objectives and Functions – Evolution of Operating Systems – Computer Organization – Operating System Operations – Services – System Calls – System Programs – Operating System Structure – OS Generation – System Boot. Processes: Process concept – Process scheduling – Operations on processes – Inter process communication – Threads: Overview – Multicore Programming – Multithreading Models. Case Study: Linux Process and Thread Managements.		
Topic - 2	PROCESS SCHEDULING AND SYNCHRONIZATION	**9**
CPU Scheduling: Concepts – Scheduling criteria – Scheduling algorithms. Process Synchronization: The critical section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Monitors. Deadlocks: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock. Case Study: Linux Scheduling		
Topic - 3	MEMORY MANAGEMENT	**9**
Main Memory: Background – Swapping – Contiguous memory allocation – Paging – Segmentation. Virtual Memory: Background – Demand paging – Page replacement – Allocation of frames – Thrashing. Case Study: Linux Memory Management.		
Topic - 4	FILE SYSTEMS	**9**
File-System Interface: File concept – Access methods – Directory and disk structure – File-system mounting – Sharing and Protection. File-System Implementation: Structure and Implementation – Directory implementation – Allocation methods – Free-space management. Case Study: Linux Virtual File System.		
Topic - 5	I/O SYSTEMS	**9**
I/O Systems: I/O Hardware - Mass Storage Structure: Overview, Disk Structure and Attachment - Disk Scheduling and Management – Swap-space management – RAID. Mobile OS:iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2013.
2	William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011.
3	Andrew S. Tanenbaum, “Modern Operating Systems”, Third Edition, Pearson Education, 2009.
4	Harvey M. Deital, “Operating Systems”, Third Edition, Pearson Education, 2004.
5	D M Dhamdhere, “Operating Systems: A Concept-Based Approach”, 3rd Edition, Tata McGraw-Hill Education, 2007

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106108101/ “Introduction to operating system”, Prof P.C.P. Bhatt , IISc-Bangalore
2	https://nptel.ac.in/courses/106106144/2/ “Introduction to operating system”, Prof Chester Rebeiro,IIT-Madras.

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSCT5	PYTHON PROGRAMMING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify and make use of python programming elements to solve and debug simple logical problems.	K2	1
CO2	Experiment with the various control statements in Python.	K3	2
CO3	Develop python programs using functions and strings.	K3	3
CO4	Experiment with the usage of pointers and functions.	K3	4
CO5	Analyze a problem and use appropriate packages and modules to solve it.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3			2	3	2	3	3	3	3	3		
CO2			2			3	2	3	3	3	3	3		
CO3			2			3	2	3	3	3	3	3		2
CO4			2		2	3	2	3	3	3	3	3	2	2
CO5	3	3	2			3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**BASICS OF PYTHON PROGRAMMING**	**9**
Introduction - Python Interpreter - Interactive and script mode -Values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments.		
Topic - 2	**CONTROL STATEMENTS AND FUNCTIONS IN PYTHON**	**9**
Conditional (if), alternative (if-else), chained conditional (if-elif-else) – Iteration - while, for, break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.		
Topic - 3	**DATA STRUCTURES: STRINGS,LISTSAND SETS**	**9**
Strings - String slices, immutability, string methods and operations –Lists - creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions - list processing - list comprehension, searching and sorting, Sets - creating sets, set operations		
Topic - 4	**DATA STRUCTURE STUPLES, DICTIONARIES**	**9**
Tuples - Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value – Dictionaries - operations and methods, Nested Dictionaries.		
Topic - 5	**FILES,MODULES,PACKAGES**	**9**
Files and exception: text files, reading and writing files format operator-Command line arguments-errors and exceptions-handling exceptions –Modules-Packages-illustrative programs-word count-copy file.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Ashok NamdevKamthane,Amit Ashok Kamthane, “Programming andProblem Solving with Python” , Mc-Graw Hill Education,2018.
2	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second edition, Updated for Python 3, Shroff / O’Reilly Publishers,2016.
3	Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt.Ltd.,2016.
4	Timothy A. Budd,” Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,2015.
5	Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning,2012.

OTHER REFERENCES	
1	https://www.coursera.org/specializations/python
2	https://www.youtube.com/watch?v=rfscVS0vtbw
3	https://nptel.ac.in/courses/106/106/106106212/

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO06	CLOUD COMPUTING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Analyze and identify a specific cloud deployment model and delivery model to adopt for any given cloud application.	K4	1
CO2	List the role of data center, virtualization, web, multitenant and service technologies in providing resilient, elastic and cost-efficient computing for a given cloud system.	K4	2
CO3	Plan and identify the required cloud computing mechanisms to deploy in cloud architectures when developing a given cloud application.	K3	4
CO4	Explain and evaluate the ability of cloud computing architectures to meet a set of requirements for a given business application.	K2	5
CO5	Inspect suitable security mechanism to provide security for a given cloud application.	K4	3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2		2			1	3	3		3		2
CO2	2		1	2	1	1	1	1	3	3	1	3	2	
CO3		3						1	3	3	3	3	2	1
CO4	1		1	1			1	1	3	3		3	1	2
CO5	1	2			3	2	1	1	3	3	1	3		3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**UNDERSTANDING CLOUD COMPUTING**	**9**
Origins and Influences–Basic Concepts and Terminology – Goals and Benefits–Risks and Challenges– Roles and Boundaries– Cloud Characteristics–Cloud Delivery Models: IaaS, PaaS, SaaS – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds.		
Topic - 2	**CLOUD ENABLING TECHNOLOGY**	**9**
Data Center Technology – Virtualization Technology– Web Technology– Multitenant Technology– Service Technology– Case study : VM installation and deployment.		
Topic - 3	**CLOUD COMPUTING MECHANISM**	**9**
Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.		
Topic - 4	**CLOUD COMPUTING ARCHITECTURE**	**9**
Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images – Case study examples		
Topic - 5	**SECURITY IN THE CLOUD**	**9**
Lambda Expression – Lambda Parameters - Functional Interfaces - Creating Thread- Stream API – Creating Java streams - Intermediate Operations: map – filter – sort – Terminal Operations: Collect – reduce – foreach - try with resources. Java Database Connectivity - Manipulating Databases with JDBC.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Thomas Erl, ZaighamMahood, Ricardo Puttini, “Cloud Computing, Concept, Technology and Architecture”, Prentice Hall, 2013..
2	K.Chandrasekaran, “Essentials of Cloud Computing”, CRC Press, 2015.
3	Kai Hwang, Geoffrey C Fox, Jack J.Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers,2012
4	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing‖, Tata McGrawHill, 2013.
5	“ ArshdeepBahga, Vijay Madisetti, ―Cloud Computing: A Hands-On Approach‖, Universities Press, 2014..

OTHER REFERENCES	
1	. .https://nptel.ac.in/courses/106/105/106105223/,“Google Cloud Computing Foundation Course”, Prof. Soumya Kanti Ghosh, IIT Kharagpur.

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO07	ARTIFICIAL INTELLIGENCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Apply a suitable set of production rules or apply constraint satisfaction technique to solve a given problem in AI.	K3	1
CO2	Discover the appropriate search strategy to find an optimal solution for a given AI problem.	K4	2
CO3	Apply resolution procedure to derive conclusion from the given set of statements in knowledge representation	K3	3
CO4	Inspect Bayesian theory, Bayesian networks, Dumpster Shafer theory for probabilistic reasoning to handle uncertainty.	K4	4
CO5	Explain the ability of AI to solve problems in the areas of Natural Language Processing and Robotics.	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2				1	1	3	3		3	2	3
CO2	3	3		2				1	3	3		3		
CO3	3	2				2	1	1	3	3		3		
CO4	2	3		2			1	1	3	3		3		
CO5	2	2						1	3	3		3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTELLIGENT AGENTS**	**9**
Introduction- What is AI-Why AI? -Foundation of AI- History of AI- Intelligent Agents: Agents and Environments - Characteristics–Structure of Agents. Problem formulation-Production systems-Problem characteristics-Production system characteristics- Constraints Satisfaction Problems.		
Topic - 2	**PROBLEM SOLVING METHODS**	**9**
Search Strategies- Uninformed Search strategies :BFS-Uniform-cost search-DFS-Iterative Deepening DFS Bidirectional Search. Informed Search strategies: Greedy BFS-A* search– Local Search Algorithms and Optimization Problems.		
Topic - 3	**KNOWLEDGE REPRESENTATION**	**9**
Knowledge Representation -Using Predicate logic :Representing simple facts-Representing instance and ISA re relationships-Computable functions and predicates- Resolution – Forward chaining - Backward chaining.		
Topic - 4	**UNCERTAINITY AND PROBABLISTIC REASONING**	**9**
Uncertainty: Acting under Uncertainty-Inference using Full Joint Distributions -Bayes' rule. Probabilistic Reasoning: Semantics of Bayesian networks-Exact Inference- Dempster- Shafer theory-Fuzzy set and fuzzy logic		
Topic - 5	**AI APPLICATIONS**	**9**
Natural Language Processing: Information Retrieval- Information Extraction–Speech Recognition .Robotics : Hardware – Perception – Planning – Moving.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Stuart Russel and Peter Norvig "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education.
2	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", 3 rd Edition, McGraw Hill- 2008
3	Deepak Khemani ,"A First Course in Artificial Intelligence", Tata Mc Graw Hill Education 2013.
4	Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5	" M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106106126/1,"Introduction, State space search, Heuristic search, problem decomposition, Planning, Constraint satisfaction", Prof. Deepak Khemani, Department of Computer Science and Engineering, IIT, Madras.

Semester	Programme	Course Code	Course Name	L	T	P	C
		20IT6T1	BIG DATA ANALYTICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Identify the type of data based on the characteristics of datasets, compare trivial data with big data and explain the lifecycle of data analytics for real world applications.	K2	1
CO2	Discover the storage and processing techniques for big data and apply them for a given scenario using Hadoop.	K4	2
CO3	Analyze big data using quantitative, qualitative and machine learning approaches and implement regression, clustering and classification algorithm for a given big data application.	K4	3
CO4	Build data models and computing models used for data analytics and apply predictive modeling for processing unstructured data.	K3	4
CO5	Develop analytical models for financial services, banking and recommender systems using marketing analysis, sentiment analysis and predictive analysis	K3	5

PRE-REQUISITE	**NIL**

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	3	3		2			1	3	3		3	2	2
CO4	3	2			1			1	3	3		3		
CO5	3	2	3		2			1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF BIG DATA**	**9**
Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data – Big Data Analytics Lifecycle - Enterprise Technologies and Big Data Business Intelligence. Case Study: Identifying data characteristics and types of data.		
Topic - 2	**STORING AND PROCESSING BIG DATA**	**9**
Big Data Storage Concepts: Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, CAP Theorem, ACID, BASE - Big Data Processing Concepts: Parallel Data Processing, Distributed Data Processing, Hadoop, Processing Workloads, Cluster, Processing in Batch Mode, Processing in Realtime Mode - Big Data Storage Technology: On-Disk Storage Devices, In-Memory Storage Devices.		
Topic - 3	**BIG DATA ANALYSIS**	**9**
Quantitative Analysis – Qualitative Analysis – Data Mining – Statistical Analysis – Machine Learning – Semantic Analysis – Visual Analysis – Case Study : Correlation – Regression – Time Series Plot – Clustering – Classification.		
Topic - 4	**ANALYTICS MODELS – PREDICTIVE MODELING**	**9**
Introduction – Data Models – Computing Models. Predictive Modeling for Unstructured Data: Introduction – Applications of Predictive Modeling – Featured Engineering – Pattern Mining.		
Topic - 5	**APPLICATIONS FOR BIG DATA ANALYTICS**	**9**
Big Data Analytics for Financial Services and Banking: Introduction – Customer insights and marketing analysis – Sentiment Analysis – Predictive Analytics – Model Building – Fraud detection and Risk Management – Integration of Big Data Analytics into operations. Big Data Analytics and Recommender Systems: Introduction – Background – Overview – Evaluations of Recommenders – Issues.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	C.S.R. Prabhu, Aneesh SreevallabhChivukula, Aditya Mogadala, Rohit Ghosh, L.M. Jenila, "Big Data Analytics: Systems, Algorithms, Applications", First edition, Springer, 2019.
2	Paul Buhler, Wajid Khattak, Thomas Erl, "Big Data Fundamentals: Concepts, Drivers & Techniques", Second Edition, Prentice Hall, 2016.
3	Anil Maheshwari, "Data Analytics" , First Edition, Tata Mcgraw Hill, 2017.
4	Venkat Ankam, "Big Data Analytics", First Edition, Packt Publishing Limited, 2016.
5	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", First Edition, Wiley, 2015.

OTHER REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc16_mg06, "Introduction to Data Analytics", Dr. Nandan Sudarsanam, Dr. Balaraman Ravindran, IIT- Madras
2	https://nptel.ac.in/courses/106104135/48, "Big Data", Prof.ArnabBhattaacharya, IIT-Kanpur.
3	https://lecturenotes.in/subject/884/big-data-analysis-bda/note
4	https://www.youtube.com/watch?v=pkPdhznqEI4

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO09	INTERNET OF THINGS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	To acquire specific scripting knowledge to develop interactive applications	K2	1
CO2	To understand basis of android application development	K3	2
CO3	To apply the programming skills in developing application in Agricore	K5	3
CO4	To apply the programming skills in developing application to enable smart cities.	K3	4
CO5	To apply the programming skills in developing application in Healthcare	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	2	2	3	3	2	3	-	-
CO2	1	2	3	2	2	-	2	2	3	3	-	3	-	2
CO3	3	2	2	-	-	-	2	2	3	3	2	3	-	2
CO4	1	3	2	2	-	-	2	2	3	3	-	3	2	-
CO5	3	2	-	-	-	-	2	2	3	3	3	3	-	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF IOT**	**9**
Introduction , Definitions &Characteristics of IOT, IOT Architectures , Physical & Logical Design of IOT ,Enabling Technologies in IOT , History of IOT, About things in IOT, The identifiers in IOT, About the Internet in IOT , IOT frameworks, IOT and M2M		
Topic - 2	**INDUSTRIAL INTERNET APPLICATIONS**	**9**
Industrial internet application:- IOT Fundamentals and components , industrial Manufacturing , monitoring , control , optimization and autonomy , introduction to Hadoop and big data analytics.		
Topic - 3	**APPLICATIONS IN AGRICULTURE**	**9**
Applications in agriculture :- Smart Farming : Weather monitoring , Precision farming , Smart Greenhouse , Drones for pesticides		
Topic - 4	**APPLICATIONS IN IOT**	**9**
Introduction :- Applications in iot enabled smart cities :- Energy consumption , smart energy meters, Home automation , smart grid and solar grid energy harvesting , intelligent parking data lake services scenarios		
Topic - 5	**HEALTH CARE APPLICATIONS**	**9**
Introduction: Architecture of iot for health care, Multiple views coalescence, SBC –ADL to construct the system architecture. Use Cases Wearable devices for remote monitoring of Physiological, ECG, EEG, Diabetes and Blood pressure.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Muthusubramanian R, Salivahanan S and Muraleedaharan K A . : "Basic Electrical , Electronics and Computer Engineering ",Tata Mcgraw Hill,second Edition.(2006
2	Olivier Hersent , David Boswarthick, Omar Elloumi , " The Internet of Things : Key applications and protocols " Willey Publications 2nd edition,2013.
3	Marco Schwartz – Internet od Things with the Arduino Yun,Packt Publishing ,2014
4	Adrian McEwen,Hakim cassimally, "Designing the Internet of Things ",Willey Publications 2012.

OTHER REFERENCES	
1	https://en.wikipedia.org/wiki/Internet_of_things
2	https://builtin.com/internet-things
3	https://youtu.be/LlhmzVL5bm8
4	https://youtu.be/6mBO2vqLv38?t=3