ERODE SENGUNTHAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University)

PERUNDURAI, ERODE - 638 057

UG Curriculum and Syllabus

(1 to 8 Semesters)

B.E – COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

REGULATION 2019

ERODE SENGUNTHAR ENGINEERING COLLEGE

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REGULATION – 2019
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULAM

Induction Program (Mandatory)	3 weeks duration
Induction program for students to be offered right at the start of the first year	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept. / Branch & Innovations

B.E. COMPUTER SCIENCE AND ENGINEERING
Minimum credits to be earned: 163 (for Eight Semester)
(for the Students Admitted in 2020-2021 onwards)

SEMESTER I

THEORY

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19BS101	Calculus and its Applications	I,III	1,2,3,4,12	2	3	1	0	4	40	60	100	BS
19BS102	Engineering Physics	I	1,2,4,5,6,8,9	-	2	0	2	3	40	60	100	BS
19BS103	Engineering Chemistry	I,III	1,2,3,4,5,7,12	-	3	0	0	3	40	60	100	BS
19HS101	Communicative English	II	2,3,6,9,10,12	3	3	0	0	3	40	60	100	HS
19ES101	Python Programming	I, III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	ES
19TPS01	Soft Skill -1	II,III	8,9,10,12	3	1	0	1	1.5	40	60	100	EEC

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19ES104	Python Programming Laboratory	I,III	1,2,3,4,5,12	1,2	0	0	2	1	60	40	100	ES
19ES106	Engineering Graphics	IV	1,2,3,5,10,12	-	0	0	4	2	60	40	100	ES
19BS105	Chemistry Laboratory	III	1,2,3,4,5,12	-	0	0	4	2	60	40	100	BS
	TOTAL				15	1	13	22.5	420	480	900	-

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		SEMESTER II											
THEORY													
Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19BS201	Vector Calculus and Complex Variables	I,III	1,2,3,4,12	2	3	1	0	4	40	60	100	BS
19BS204	Physics for Information Science	I	1,3,4,5,7	-	3	0	0	3	40	60	100	BS
19MC201	Environmental Science and Engineering	I, II	1,2,3,4,5,6,7,8,12	-	3	0	0	0	40	60	100	MC
	Language Elective	III	2,3,6,9,10,12	3	3	0	0	3	40	60	100	HS
19ES202	Advanced C Programming	I, III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	ES
19ES203	Fundamentals of Electrical and Electronics Engineering	I, IV	1,2,3,4	-	3	0	0	3	40	60	100	ES
19TPS02	Soft Skill -II	II,III	8,9,10,12	3	1	0	1	1.5	40	60	100	EEC
PRACTICAL													
19ES214	Advanced C Programming Laboratory	I, II	1,2,3,4,12	1,2	0	0	4	2	60	40	100	ES
19ES215	Computer Hardware Installation and Servicing, Laboratory	I, II	1, 2, 3, 12	2	0	0	2	1	60	40	100	ES
				TOTAL	19	1	7	20.5	400	500	900	-

SEMESTER III

THEORY

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
		Objective & Outcomes							**Maximum Marks**			
19BS305	Discrete Mathematics	I,III	1,2,3,4	2	3	1	0	4	40	60	100	BS
19ES302	Digital Electronics	I, III, IV	1,2,3,4,12	2	3	0	0	3	40	60	100	ES
19CS302	Computer Architecture	I, III	1,2,3,4,12	2	3	0	0	3	40	60	100	PC
19CS303	Object Oriented Programming using Java	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PC
19CS304	Data Structures	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PC
19TPS03	Quantitative Aptitude and Logical Reasoning - I	I, II,III	1,2,9,10,12	3	2	0	0	0	40	60	100	EEC
19MC301	Indian Constitution	II,III	6,8,10,11,12	-	2	0	0	0	40	60	100	MC

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19ES308	Digital Electronics Laboratory	I, III	1,2,3,4,5,12	2	0	0	4	2	60	40	100	ES
19CS305	Data Structures Laboratory	I,III	1,2,3,4,5,9,11, 12	1,2	0	0	4	2	60	40	100	PC
19CS306	Java Programming Laboratory	I, III	1,2,3,4,12	1,2	0	0	4	2	60	40	100	PC
	TOTAL				19	1	12	22	460	540	1000	-

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SEMESTER IV

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19BS405	Probability and Stochastic Models	I,III	1,2,3, 4,12	2	3	1	0	4	40	60	100	BS
19CS401	Design and Analysis of Algorithms	I, III	1,2,3,4,12	1, 2	3	0	0	3	40	60	100	PC
19HS402	Universal Human Values 2 : Understanding Harmony				2	1	0	3	40	60	100	HS
19CS403	Computer Networks	I, III	1,2,3,4, 8,10,12	1,2	3	0	0	3	40	60	100	PC
19CS404	Operating Systems	I, III	1,2,3, 4,12	1,2	3	0	0	3	40	60	100	PC
19IT302	Data Base Management Systems	I, III	1,2,3, 4,12	1,2	3	0	0	3	40	60	100	PC
19TPS04	Quantitative Aptitude and Logical Reasoning - II	I, II, III	1,2,9, 10,12	3	2	0	0	0	40	60	100	EEC

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19CS405	Data Base Laboratory	I, II, III	1,2,3,4, 5,9,10, 11,12	1,2	0	0	4	2	60	40	100	PC
19CS406	Networking Laboratory	I, III	1,2,3, 4,5,12	1,2	0	0	4	2	60	40	100	PC
19HS401	Language Skills	II	5,9, 10,12	3	0	0	2	-	100	-	100	EEC
		TOTAL			19	2	10	23	500	500	1000	-

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SEMESTER V

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CS501	Web Technology	I,III	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	PC
19CS502	Theory of Computation	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PC
	Open Elective I				3	0	0	3	40	60	100	OE
19CS503	Software Engineering	I, III	1,2,3,4,5,8,9,10,11,12	1,2	3	0	0	3	40	60	100	PC
	Professional Elective I				3	0	0	3	40	60	100	PE
19TPS05	Quantitative Aptitude and Logical Reasoning - III	I,II,III	1,2,9,10,12	3	2	0	0	0	40	60	100	EEC

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19CS504	Mobile Apps Development Laboratory	I, III,IV	1,2,3,4,5,6,7,8,9,10,11 12	1,2	0	0	4	2	60	40	100	PC
19CS505	Web Technology Laboratory	I,III	1,2,3,4,5,8,9,12	1,2	0	0	4	2	60	40	100	PC
19HS506	Professional Skills for Software Engineer	II	2,3,6,8,9,12	3	0	0	2	-	100	-	100	EEC
	TOTAL				17	0	10	19	460	440	900	-

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SEMESTER VI

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CS601	Cryptography and Network Security	I,II,III	1,2,3,4, 5,6,8,12	1,2	3	0	0	3	40	60	100	PC
19CS602	Compiler Design	I,III	1,2,3, 4,12	1,2	3	0	0	3	40	60	100	PC
19CS603	Foundations of Internet of Things	I,III IV	1,2,3,4, 5,6,7,10, 11,12	1,2	2	0	2	3	40	60	100	PC
19CS604	Cloud Computing	I,III	1,2,3,4, 5,10,12	1,2	3	0	0	3	40	60	100	PC
19TPS06	Quantitative Aptitude and Logical Reasoning - IV	I, II,III	1,2,9, 10,12	3	2	0	0	0	40	60	100	EEC
	Open Elective II				3	0	0	3	40	60	100	OE
	Professional Elective II				3	0	0	3	40	60	100	PE

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19CS605	Network Security Laboratory	I,II,III	1,2,3,4,5 6,8,12	1,2	0	0	4	2	60	40	100	PC
19CS606	Mini Project	I, II, III, IV	1,2,3,4, 5,6,7, 8,9,10, 11,12	1,2, 3	0	0	2	1	100	-	100	EEC
19CS607	Comprehensive Review	I,III	10,12	1,2	0	0	2	0	100	-	100	EEC
				TOTAL	19	0	10	21	540	460	1000	-

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SEMESTER VII

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CS701	Big Data Analytics	I,II,III	1,2,3,4, 5,12	1,2	3	0	0	3	40	60	100	PC
19CS702	Artificial Intelligence	I,II,III	1,2,3,4, 5,12	2	3	0	0	3	40	60	100	PC
19ES701	Research Methodology	I, II	1,2,3,4, 12	-	3	0	0	3	40	60	100	ES
	Professional Elective III				3	0	0	3	40	60	100	PE
	Professional Elective IV				3	0	0	3	40	60	100	PE
	Open Elective III	I,II, IV	1,2,3,4, 5,6,7, 11,12	1,2	3	0	0	3	40	60	100	OE
PRACTICAL												
19CS704	Cloud Computing Laboratory	I,II,III	1,2,3,4, 5,9,10, 11,12	2	0	0	4	2	60	40	100	PC
19CS705	Data Analytics Laboratory	I,II,III	1,2,3,4, 5,9,10, 12	2	0	0	4	2	60	40	100	PC
19CS706	Project work Phase I	I,II,III, IV	1,2,3,4, 5,6,7,8, 9, 10, 11,12	1,2,3	0	0	2	1	60	40	100	EEC
TOTAL					18	0	10	23	460	440	900	-

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SEMESTER VIII

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
	Professional Elective V				3	0	0	3	40	60	100	PE
	Professional Elective VI				3	0	0	3	40	60	100	PE

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19CS801	Project work Phase II	I, II, III, IV	1,2,3,4, 5,6,7, 8,9,10, 11,12	1,2,3	0	0	12	6	60	40	100	EEC
	TOTAL				6	0	14	12	240	160	400	-

S. No.	Category	Credits Per Semester								Total Credit	Credits in %	Range of Total Credits (AICTE)	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	12	7	4	4	-	-	-	-	27	16.56	15%	20%
2	ES	6	9	5	-	-	-	3	-	23	14.11	10%	15%
3	HS	3	3	-	3	-	-	-	-	9	5.52	5%	10%
4	PC	-	-	13	16	13	14	10	-	69	40.49	40%	45%
5	PE	-	-	-	-	3	3	6	6	18	11.04	10%	15%
6	OE	-	-	-	-	3	3	3	-	9	5.52	5%	10%
7	EEC	1.5	1.5	-	-	-	1	1	6	11	6.75	5%	10%
	Total	22.5	20.5	22	23	19	21	23	12	163	100	90%	125%

BS- Basic Science   **ES**-Engineering Science   **HS**-Humanities and Social Science
PE- Professional Elective   **OE**- Open Elective   **PC**- Professional Core
MC – Mandatory course   **CA** – Continuous Assessment
ES- End semester Examination   **EEC**-Employability Enhancement Course

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MANDANTORY COURSES

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19MC201	Environmental Science and Engineering	I, II	1,2,3,4, 5,6,7,8, 12	-	3	0	0	0	40	60	100	MC
19MC301	Indian Constitution	II,III	6,8,10, 11,12	-	2	0	0	0	40	60	100	MC

LANGUAGE ELECTIVES

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19HX201	English for Engineers	III	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS
19HX202	Hindi	III	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS
19HX203	Japanese	III	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS
19HX204	French	III	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS

OPEN ELECTIVES OFFERED BY CSE

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSOE01	Web Development using .NET		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE02	Fundamentals of Open Source Software		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE03	Machine Learning using R		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE04	Fundamentals of Cloud Computing		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE05	Computer Organization & Architecture		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE06	Principles of User Interface Design		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE07	Fundamentals of Database Management Systems		1,2,3,4, 12		3	0	0	3	40	60	100	OE
19CSOE08	Operating Systems Fundamentals		1,2,3,4, 12		3	0	0	3	40	60	100	OE

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE - I

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSPE01	C# and .NET Programming	I,III	1,2,3,4, 12	1, 2	3	0	0	3	40	60	100	PE
19CSPE02	Advanced Java Programming	I, III	1,2,3,4, 5, 12	1, 2	3	0	0	3	40	60	100	PE
19CSPE03	Open Source Systems	I, III	1,2,3,4, 5, 12	1, 2	3	0	0	3	40	60	100	PE
19CSPE04	R Programming	I, III	1,2,3,4, 5, 12	1, 2	3	0	0	3	40	60	100	PE
19CSPE05	XML and Web Services	I,III	1,2,3,4,5 12	1, 2	3	0	0	3	40	60	100	PE
19CSPE06	Graph Theory and Its applications	I, III	1,2,3,4,1 2	1,2	3	0	0	3	40	60	100	PE
19CSPE07	Computer Vision	I, III	1,2,3,4,5	1,2	3	0	0	3	40	60	100	PE

PROFESSIONAL ELECTIVE II

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSPE08	Human Computer Interface	I,III	1,2,3, 4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE09	Computer Graphics and Multimedia	I,III	1,2,3, 4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE10	Digital Image Processing	I,III	1,2,3,4	1,2	3	0	0	3	40	60	100	PE
19CSPE11	Distributed Computing	I,III	1,2,3, 4,12	1,2	3	0	0		40	60	100	PE
19CSPE12	Information Retrieval Techniques	I,III	1,2,3, 4,12	1,2	3	0	0	3	40	60	100	PE
19CSPE13	Social Network Analysis	I,III	1,2,3, 4,6,7, 12	1,2	3	0	0	3	40	60	100	PE
19CSPE14	Data warehousing and Data mining	I,III	1,2,3, 4,512	1,2	3	0	0	3	40	60	100	PE

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PROFESSIONAL ELECTIVE III

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSPE15	Software Project Management	I,III	1,12	2	3	0	0	3	40	60	100	PE
19CSPE16	Cyber Security and Ethical Hacking	I,III	1,2,5,12	1	3	0	0	3	40	60	100	PE
19CSPE17	Wireless Sensor Networks	I,III	1,2,3,4	1	3	0	0	3	40	60	100	PE
19CSPE18	Professional Ethics in Engineering	I,III	1,2,3,4,12	2	3	0	0		40	60	100	PE
19CSPE19	Semantic Web	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PE

PROFESSIONAL ELECTIVE IV

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSPE20	Information Storage Management	I,III	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE21	Soft Computing	I,III	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE22	Natural Language Processing	I,III	1,2,3,4	1,2	3	0	0	3	40	60	100	PE
19CSPE23	Management Information System	I,III	1,2,3,4,12	1,2	3	0	0		40	60	100	PE
19CSPE24	Speech Processing	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PE
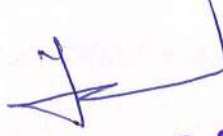
PROFESSIONAL ELECTIVE V

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSPE25	Parallel Algorithms	I,III	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE26	Software Quality Assurance	I,III	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE27	Robotics	I,III	1,2,3,4	1,2	3	0	0	3	40	60	100	PE
19CSPE28	Virtual and Augmented Reality	I,III	1,2,3,4,12	1,2	3	0	0		40	60	100	PE
19CSPE29	Bio Informatics	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PE

PROFESSIONAL ELECTIVE VI

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSPE30	Block Chain Technology	I,III	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE31	Data Visualization Techniques	I,III	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	PE
19CSPE32	Realtime systems	I,III	1,2,3,4	1,2	3	0	0	3	40	60	100	PE
19CSPE33	Design Patterns	I,III	1,2,3,4,12	1,2	3	0	0		40	60	100	PE
19CSPE34	Quantum Computing	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PE

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Department	B.E. COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester I	BS
Course Code	**Course Name**	**Hours/Week**			**Credit**	**Total Hours**	**Maximum Marks**
		L	T	P	C		
19BS101	CALCULUS AND ITS APPLICATIONS	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to
- Interpret the introductory concepts of Limit and continuity
- Interpret the introductory concepts of calculus, this will enable them to model and analyze physical phenomena involving continuous change of variables
- Find eigen values and eigen vectors which is one of the powerful tools to handle practical problems arising in the field of engineering.
- Summarize and apply the methodologies involved in solving problems related to functions of several variables.
- Develop enough confidence to identify surface and area there by solving using integration

Course Outcomes: At the end of this course, learners will be able to:
- Apply differentiation to solve maxima and minima problems use both the limit definition and rules of differentiation to differentiate functions
- Identify and model the real time problems using first order linear differential equations. Recognize and solve the higher order ordinary differential equations.
- Analyze the characteristics of a linear system with Eigen values and Eigen vectors.
- Characterize the functions of several variables and get the solutions of the same.
- Integrate the functions for evaluating the surface area and volume.

Unit I	LIMITS AND CONTINUITY	12

Repesentation of a function-Limit of a function-Continuty-Derivatives-Differentiation rules-Maxima and Minima of one variable

Unit II	ORDINARY DIFFERENTIAL EQUATIONS	12

Linear differential equations of second and higher order with constant coefficients. Linear differential equations of higher order with variable coefficients: Cauchy's linear differential equation - Method of variation of parameters for second order differential equations-Vibrating string-Electrical circuits
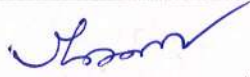
Unit III	MULTIVARIABLE CALCULUS	12

Functions of Two Variables - Total Differential - Derivative of implicit functions- Jacobian's- constrained maxima and minima

Unit IV	MULTIPLE INTEGRALS	12

Double integration with constant and variable limits-Region of integration -Change the order of integration - Area as double integral in cartesian coordinates. Triple integral in Cartesian coordinates.

Unit V	EIGEN VALUES AND EIGEN VECTORS	12

Eigen Values and Eigen Vectors of a real matrix - Properties of Eigen Values- Cayley - Hamilton Theorem Orthogonal matrix- Diagonalisation-Quadratic form: Reduction of a quadratic form to a canonical form.

REFERENCE(S):

1.	Thomas Calculus, 14th Edition by Pearson
2.	Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2015.
3.	Peter V. O Neil , Advanced Engineering Mathematics, Eight Edition , Cengage Learning India Private Limited, 2018
4.	C. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
5.	Glyn James, Advanced Engineering Mathematics, Third Edition, Wiley India, 2014.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS102	ENGINEERING PHYSICS	2	0	2	3	60	100	

Course Objective (s): The purpose of learning this course is
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology
- To get the basic knowledge on the properties of matters
- To acquire knowledge in Ultrasonics, Laser and fibers
- To enhance the knowledge in quantum theory
- To understand basic concepts of thermal properties of materials

Course Outcomes: At the end of this course, learners will be able :
- To gain knowledge on the basics of properties of matter and its applications
- To acquire knowledge on the concepts of Ultrasonics and their applications
- To have adequate knowledge on the concepts of fiber & Laser and their applications
- To get knowledge on advanced Physics concepts of quantum theory and its applications in tunneling microscopes and
- To understand knowledge on the concepts of thermal properties of materials and their applications in expansion of joints and heat exchangers

Unit I	PROPERTIES OF MATTER	6

Elasticity – Stress-strain diagram and its uses - torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders.

Unit II	ULTRASONICS	6

Introduction–Classification of Sound- Ultrasonics Production - Magnetostriction generator - Piezo electric generator-cavitations-ultrasonic cleaning-Non Destructive Testing- Pulse echo system through transmission and reflection modes- A, B and C – scan displays- Engineering Applications-Cutting, welding and drilling.

Unit III	LASER AND FIBRE OPTICS	6

Lasers: population of energy levels, Einstein's A and B coefficients derivation – Semiconductor lasers: homojunction and heterojunction – Industrial applications of laser. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – fibre optic sensors: pressure and displacement.

Unit IV	QUANTUM PHYSICS	6

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box.

Unit V	THERMAL PHYSICS	6

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - 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) – applications: heat exchangers, ovens and solar water heaters.

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TEXT BOOK(S):	
1.	Bhattacharya, D.K. & Poonam, T. —Engineering PhysicsII. Oxford University Press, 2015
2.	Gaur, R.K. & Gupta, S.L. —Engineering PhysicsII. Dhanpat Rai Publishers, 2012
3	Pandey, B.K. & Chaturvedi, S. —Engineering PhysicsII. Cengage Learning India, 2012

REFERENCE(S):	
1.	Halliday, D., Resnick, R. & Walker, J. —Principles of PhysicsII. Wiley, 2015
2.	Serway, R.A. & Jewett, J.W. —Physics for Scientists and EngineersII. Cengage Learning, 2010
3.	Tipler, P.A. & Mosca, G. - Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007

List of Experiments
PHYSICS (ANY FIVE)   30 hrs

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. Determination of Young's modulus by uniform bending method
4. Determination of wavelength and particle size using Laser
5. Determination of acceptance angle and numerical aperture in an optical fiber
6. Determination of thermal conductivity of a bad conductor – Lee's Disc method
7. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
8. Determination of wavelength of mercury spectrum – spectrometer grating
9. Determination of band gap of a semiconductor
10. Determination of thickness of a thin wire – Air wedge method

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	I
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS103	ENGINEERING CHEMISTRY	3	1	0	4	45	100	

Course Objective (s): The purpose of learning this course is to
- Understand the basic concepts of water characterization and treatment methods.
- Know the fundamental concepts of electrochemistry and corrosion.
- Understand the principles and generation of energy in batteries and nuclear reactors.
- Gain knowledge on polymers.
- Know the types of fuels and the manufacture of solid, liquid and gaseous fuels.

Course Outcomes: At the end of this course, learners will be able to:
- Make the students conversant with water treatment techniques
- Know the reaction involved in corrosion and corrosion protection methods
- Impart knowledge on renewable energy sources like nuclear and to impart knowledge on energy storage devices
- Aware the synthesis & industrial application of polymers
- Impart knowledge on different types of fuels (solid liquid, gas, primary, secondary and synthetic) and combustion process.

Unit I	WATER CHEMISTRY	9

Hardness of water – types – Estimation of hardness of water by EDTA method– – Domestic water treatment-boiler troubles (scales,sludge,priming,foaming,caustic embrittlememt) – Internal conditioning (carbonate,phosphate, sodium aluminate and calgon) .External treatment – Demineralization process – Reverse Osmosis.

Unit II	ELECTROCHEMISTRY AND CORROSION	9

Electrochemical cell - redox reaction, electrode potential- Nernst equation (derivation and problems).Standard hydrogen electrode-Calomel Electrode. Corrosion: chemical & electrochemical corrosion (galvanic, differential aeration) - types-factors influencing corrosion rate corrosion control - sacrificial anode and impressed current cathodic protection method.

Unit III	ENERGY SOURCES	9

Introduction- nuclear energy- nuclear fission- nuclear fusion- nuclear chain reactions- light water reactor-breeder reactor. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- lithium ion battery.Fuel cell :H_2 -O_2 fuel cell.

Unit IV	POLYMER CHEMISTRY	9

Monomers - polymers - polymerization - functionality - degree of polymerization - classification of polymers based on source and applications. Types of polymerization: addition, condensation and copolymerization. Preparation, properties and applications of thermosetting (epoxy resin and bakelite) and thermoplastics (poly vinyl chloride, poly tetrafluoroethylene and PMMA). Rubber: SBR. Compounding of plastics (blow moulding, injection, extrusion) .

Unit V	FUELS AND COMBUSTION	9

Fuel: Introduction- classification of fuels- solid fuels-coal- proximate and ultimate analysis- manufacture of metallurgical coke (Otto Hoffmann method) – Liquid fuels: Refining of petroleum- synthetic petrol Fischer-Trophs and Bergius processes- knocking- octane number- cetane number – Gaseous fuels: liquefied petroleum gases(LPG)- water gas- bio diesel. Combustion- flue gas analysis (ORSAT Method).

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TEXT BOOK(S):

1.	Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2019
2.	Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2019

REFERENCE(S):

1.	Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2016.
2.	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2017.
3.	GowarikerV.R,Viswanatha.N.V,Jayadev Sreedhar-"Polymer Science",Publishing company New Age International Publishers,New Delhi,2015.
4.	Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2017.
5.	AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2015.

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Department	COMPUTER SCIENCE AND ENGINEERING					Semester	I

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HS101	COMMUNICATIVE ENGLISH	3	0	0	3	45	100

Course Objective (s):
- To acquire basic English grammar.
- To develop listening skills to listen lectures and basic videos.
- To enhance the reading skill to comprehend technical writings.
- To improve writing skills to express thoughts freely.
- To develop speaking skills to speak fluently in real contexts.

Course Outcomes: At the end of this course, learners will be able to:
1. Improve language usage in LSRW skills.
2. Develop listening skills to comprehend general / technical talks.
3. Acquire the ability to understand different written texts.
4. Enhance the writing skills to express the ideas of the learners.
5. Communicate fluently in real time context.

Unit I	LANGUAGE FOCUS	9

Parts of speech - Word formation - Sentence types (declarative, imperative, exclamatory & interrogative) - Tense forms - Subject - Verb agreement

Unit II	LISTENING	9

Listening for specific information: Short conversations / monologues - Gap filling - Telephone conversations - Telephone etiquette - Note-taking - Listening for gist / interviews - Listening to songs and completing the lyrics - Clear individual sounds - Word stress

Unit III	READING	9

Completing the sentences - Prediction - Skimming for gist - Scanning for specific information - Understanding text and sentence structure - Close reading

Unit IV	WRITING	9

Paragraph writing (descriptive, narrative, expository & persuasive) - Letter (formal and informal) - Dialogue writing - E-mail - Instructions

Unit V	SPEAKING	9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Mini-presentation - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes

TEXT BOOK(S):

1.	Communicative English by KN Shoba ,Lourdes Joavani Rayen Publised by Cambridge university 2017.

REFERENCE(S):

1	Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For Intermediate learners Of English .Ived. United Kingdom: Cambridge University Press. 2012.
2	Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
3	Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	I
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES102	PYTHON PROGRAMMING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is
- To understand problem solving concepts .
- To understand why Python is a useful scripting language for developers and to read and write simple Python programs.
- To develop Python programs with conditionals and loops
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python

Course Outcomes:

At the end of this course, learners will be able to
- Apply problems solving techniques to real world problems.
- Recognize and construct common programming idioms: variables, loop, branch, and input/output.
- Be able to design, code, and test Python programs using List, Tuples and Strings
- Able to write code using dictionaries and functions
- Able to read and write data from/to files in Python Programs.

Unit I	COMPUTATIONAL THINKING	9

Introduction to Computational Thinking –From abacus to machine – The first Software –First Modern Computer-Information and data - Converting information into data -Data Capacity Problem Solving Techniques: General problem Solving concepts-: Algorithm, Pseudo-code and Flowchart Problem Solving with Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops Case Study: Raptor and Scratch Tools.

Unit II	INTRODUCTION TO PYTHON	9

History- Features - Setting up path - Working with Python - Basic Syntax - Variable and Data Types - Operator - Conditional Statements – Looping – Control Statements

Unit III	STRING MANIPULATION, LIST AND TUPLES	9

Creating String - Accessing Strings - Basic Operations - String slices - Function and Methods – Creating List - Accessing list - Operations on List - Working with lists - Function and Methods – Creating tuple - Tuple Operations – Functions and Methods

Unit IV	DICTIONARIES AND FUNCTIONS	9

Creating Dictionaries - Accessing values in dictionaries - Working with dictionaries - Properties – Functions - Defining a function - Calling a function - Types of functions - Function Arguments - Anonymous functions - Global and local variables

Unit V	MODULES, FILES AND EXCEPTION HANDLING	9

Modules - Importing module - Math module - Random module - Packages - Composition Files - Opening and closing file- File Opening Modes - Reading and writing files – Functions Exception Handling - Exception - Exception Handling - Except clause - Try , finally clause User Defined Exceptions

TEXT BOOK(S)

1.	David Riley and Kenny Hunt, "Computational Thinking for the Modern Problem Solver", Chapman & Hall/CRC, 2014.
2.	Michael Dawson ,"Python Programming for the Absolute Beginner" , 3rd Edition, 2010.

REFERENCE(S)

1.	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.
2.	Brian Heinold, "Introduction to Programming Using Python",Mount St. Mary's University, 2013.
3.	Allen Downey, Green Tea Press Needham, "Think Python, How to Think Like a Computer Scientist", Massachusetts.
4.	Cunningham, Sams teach yourself python in 24 hours, Second edition Pearson, 2014

Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester I EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS01	SOFT SKILLS - I	1	0	2	2	45	100

Course Objective (s): The purpose of learning this course is

- To develop basic grammar knowledge in English.
- To enhance Speaking Skills in English
- To improve Verbal and Non-verbal Communication Skills
- To develop Confidence and Emotional Intelligence
- To develop Inter Personal Skills.

Course Outcomes: At the end of this course, learners will be able to:

- Have competent knowledge of grammar
- Speak fluent English by enriching Vocabulary Knowledge.
- Have good Presentation Skills through verbal and non verbal communication.
- Handle any Situation with confidence by being emotionally stable.
- Work in a team by having team coherence and dealing with people.

UNIT 1	Effective English – Written English	6

Basic rules of Grammar - Parts of Speech – Tenses – Verbs.Sentence Construction.Dialogues and Conversations – Writing. Exercises to practice and improve these skills.

UNIT 2	Effective English – Spoken English	6

Vocabulary – Idioms & Phrases – Synonyms – Antonyms.Dialogues and Conversations –Writing. Exercises to practice and improve these skills.

UNIT 3	Art of Communication & The Hidden Data Involved	6

Verbal Communication - Effective Communication - Active listening –Paraphrasing – Feedback.
Non Verbal Communication - Body Language of self and others.
Importance of feelings in communication - dealing with feelings in communication.

UNIT 4	World of Teams – Part -01	6

Self Enhancement - importance of developing assertive skills- developing self confidence – developing emotional intelligence.

UNIT 5	World of Teams – Part -02	6

Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved Working with Groups – Dealing with People- Group Decision Making.

PRACTICAL : 15 Hours

REFERENCES:
1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – Og Mandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	I
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES104	PYTHON PROGRAMMING LABORATORY	0	0	2	1	30	100	

Course Objective (s):

The purpose of learning this course is
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

Course Outcomes:

At the end of this course, learners will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

List of Experiments
- Find the Greatest among three numbers without using third variable
- Sum of the Digits of a Number
- Generation of Prime Numbers
- Implement a sequential search
- Create a calculator program
- Explore string functions
- Implement Selection Sort
- Implement Stack
- Read and write into a file
- Demonstrate usage of basic regular expression
- Demonstrate use of advanced regular expressions for data validation.
- Demonstrate use of List
- Demonstrate use of Dictionaries
- Create Comma Separate Files (CSV), Load CSV files into internal Data Structure

Platforms needed : Python 3 interpreter for Windows / Linux

TEXT BOOK(S)

1,	David Riley and Kenny Hunt, "Computational Thinking for the Modern Problem Solver", Chapman & Hall/CRC, 2014.
2	Michael Dawson ,"Python Programming for the Absolute Beginner" , 3rd Edition, 2010.

REFERENCE(S)

1.	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.
2.	Brian Heinold, "Introduction to Programming Using Python",Mount St. Mary's University, 2013.
3.	Allen Downey, Green Tea Press Needham, "Think Python, How to Think Like a Computer Scientist", Massachusetts.
4.	Cunningham, Sams teach yourself python in 24 hours, Second edition Pearson, 2014

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	I

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES108	ENGINEERING GRAPHICS	0	0	4	2	45	100

Course Objective (s): The purpose of learning this course is to
- To provide hands on training for fabrication of components using carpentry, sheet metal and welding equipment / tools.
- To gain the skills for making fitting joints and household pipe line connections using suitable tools.
- To develop the skills for preparing the green sand mould and to make simple household electrical connection
- To provide hands on training for dismantling and assembling of petrol engines, gear box and pumps.
- To develop the skills for making wood/sheet metal models using suitable tools

Course Outcomes: At the end of this course, learners will be able to:
- Fabricate simple components using carpentry, sheet metal and welding equipment/tools
- Make fitting joints and household pipe line connections using suitable tools.
- Prepare green sand mould and make simple household electrical connections using suitable tools
- Dismantle and assemble petrol engines, gear box and pumps.
- Make simple models using wood and sheet metal.

List of Experiments
1. Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box
2. Fabrication of a simple component using thin and thick plates. (Example: Book rack)
3. Making a simple component using carpentry power tools. (Example: Pen stand/Tool box/ Letter box.
4. Prepare a "V" (or) Half round (or) Square joint from the given mild Steel flat.
5. Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend,Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes,bend, gate valve, flanges and foot valve.
6. Prepare a green sand mould using solid pattern/split pattern.
7. Construct a domestic electrical wire connections using indicator, one way switch with calling bell, two way switch with lamp, one way switch with fan regulator and one way switch with socket.
8. Dismantling and assembly of Centrifugal Monoblock / Gear Pump / Gear box.
9. Dismantling and assembly of two stroke and four stroke petrol engine.
10. Mini Project (Fabrication of Small Components).

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Department	I YEAR B.E/B.TECH (COMMON TO ALL BRANCHES)					R 2019	Semester	I
Course Code	**Course Name**	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS105	**CHEMISTRY LABORATORY**	0	0	2	1	30	50	

Course Objective (s): The purpose of learning this course is to

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of chloride content of water sample by Argentometric method.
3. Estimation of iron content of the given solution using potentiometer.
4. Determination of strength of given hydrochloric acid using pH meter
5. Conductometric titration of strong acid vs strong base.

Course Outcomes: At the end of this course, learners will be able to

1. Make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis.
2. Acquire the knowledge about chloride content in water sample.
3. Make the student to acquire practical skills about strength of iron using potentiometric titrations.
4. Understand the how to estimate hydrochloric acid in water sample using pH meter.
5. Gain the knowledge about conductance of ions.
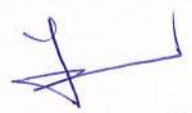
Exp No.	Name of Experiments (Any Five)
1	Determination of total, temporary & permanent hardness of water by EDTA method.
2	Determination of chloride content of water sample by argentometric method.
3	Determination of strength of given hydrochloric acid using pH meter.
4	Determination of strength of acids in a mixture of acids using conductivity meter.
5	Estimation of iron content of the given solution using potentiometer.
6	Conductometric titration of strong acid vs strong base.
7	Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer
8	Estimation of iron content of the water sample using spectrophotometer

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	II

Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS201	VECTOR CALCULUS AND COMPLEX VARIABLES	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of Calculus viz: Vector, Vector Differentiation and Vector Integration.
- Implement the Complex Analysis, an elegant method in the study of heat flow, fluid dynamics and electrostatics.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.
- Defining a complex function and solving through complex integration

Course Outcomes: At the end of this course, learners will be able to:
- Characterize the calculus of vectors.
- Apply the theoretical aspects of vector integral calculus in their core areas.
- Recognize the differentiation properties of complex functions.
- Identify the complex functions and their mapping in certain complex planes.
- Use the concepts of integration to complex functions in certain regions.

Unit I	DIFFERENTIATION OF VECTORS	12

Vector point function- Directional derivative - Gradient -Divergence -Curl - Solenoidal – Irrotational vector fields – Scalar potential

Unit II	INTEGRATION OF VECTORS	12

Work done - Line Integral - Surface integral- Green's theorem in a plane- Stoke's Theorem- Gauss divergence theorem- Applications involving cubes and parallelepiped.

Unit III	ANALYTIC FUNCTIONS	12

Analytic Functions- Necessary and Sufficient conditions of Analytic Function- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method -Applications to the problems of Potential Flow.

Unit IV	MAPPING OF COMPLEX FUNCTIONS	12

Conformal mapping- Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).

Unit V	COMPLEX INTEGRATION	12

Cauchy's Fundamental Theorem - Cauchy's Integral Formula - Taylor's and Laurent's series-Classification of Singularities - Cauchy's Residue Theorem

REFERENCE(S):

1	Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi 2015
2.	C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-HillPublishing Company Ltd, 2003
3.	J. A. Brown and R. V. Churchill, Complex Variables and Applications , Sixth Edition, McGraw Hill,New Delhi, 1996
4.	Peter V. O. Neil, Advanced Engineering Mathematics, Seventh Edition ,Cengage Learning India Private Limited, 2012
5.	Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India,2007

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	II

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19MC201	ENVIRONMENTAL SCIENCE AND ENGINEERING	3	0	0	0	45	100	

Course Objective (s): The purpose of learning this course is to
1. Study the nature and facts about environment.
2. Finding and implementing scientific, technological and economic solutions to environmental problems.
3. Know the types of natural resources and the individual role in conserving the resources.
4. Apply the knowledge to various social issues by understanding the environmental legislation laws.
5. Study the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Outcomes: At the end of this course, learners will be able to:
1. Extend their knowledge in maintaining ecological balance and make use of their knowledge in the preservation of biodiversity.
2. Outline the role of human being in maintaining a clean environment and useful environment for the future generations.
3. Explain the constituents of environment, precious resources in the environment and conservation of natural resources.
4. Find the role of government and Non-Government organization and explain the various rain water harvesting techniques.
5. Develop their awareness about population growth, Family planning programme and HIV/AIDS and extend their knowledge in role of information technology in environment & human health.

Unit I	ECOSYSTEMS AND BIODIVERSITY	10

Environment: Scope – importance - need for public awareness -Concepts of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains- food webs - types of ecosystem - structure and functions of forest ecosystem and river ecosystem – Biodiversity - value of biodiversity - consumptive use-productive use - social - ethical - aesthetic values - Hotspots of biodiversity -Threats to biodiversity - Habitat loss - poaching of wildlife and man wildlife conflicts.Conservation of biodiversity - In-situ and Ex-situ conservation.

Unit II	ENVIRONMENTAL POLLUTION	8

Pollution: Causes - effects and control measures of Air pollution - Water pollution - Soil pollution and Noise pollution - Solid waste management - Causes - effects -control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster managements - Floods - cyclone- landslides.

Unit III	NATURAL RESOURCES	9

Forest resource - Use-over exploitation -deforestation - Water resource - use-over utilization of surface and ground water - conflicts over water - Mineral resource - use-exploitation-environmental effects of extracting and using mineral resource - Food resources - world food problems changes caused by agriculture - Effects of modern agriculture - fertilizer- pesticide problems - Energy resource - Renewable energy sources - solar energy - wind energy. Land resources - land degradation - soil erosion - Role of an individual in conservation of natural resources.

Unit IV	SOCIAL ISSUES AND THE ENVIRONMENT	9

Sustainable & Unsustainable development-Water conservation - rain water harvesting (roof top method)- climate change-global warming - acid rain - ozone layer depletion - Environment protection act - Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Green Chemistry – 12 Principles of Green chemistry – Application of Green chemistry.

Unit V	HUMAN POPULATION AND THE ENVIRONMENT	9

Population growth - variation among nations - Population explosion & its consequences – Family,child, women welfare programmes - Human rights - HIV/AIDS – Human health and environment - Role of information technology in environment and human health.

TEXT BOOK(S):

1.	Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, New Delhi (2015)
2.	Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt. Ltd., Chennai,12th Edition (2016)

REFERENCE(S):

1.	Masters, Gilbert M, ―Introduction to Environmental Engineering and Sciencell, Second Edition, Pearson Education, New Delhi (2012).
2.	Santosh Kumar Garg, Rajeshwari garg, smf Ranjni Garg ―Ecological and Environmental Studiesll Khanna Publishers, Nai Sarak, Delhi (2014).
3.	R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standard", Vol. I and II, Enviro Media.
4.	Dharmendra S. Sengar, "Environmental law", Prentice Hall of India PVT LTD, New Delhi, 2007. 4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2005
5.	Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2015.

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Department	ENGLISH					R 2019	Semester	II
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX201	ENGLISH FOR ENGINEERS	3	0	0	3	45	100	

Course Objective (s):
- To acquire the usage of grammar in English language.
- To develop listening skills which will enable to listen lectures and comprehend different types of texts.
- To enhance the reading skill to comprehend technical writings.
- To improve writing skills to express thoughts freely.
- To develop speaking skills to speak fluently in real contexts.

Course Outcomes: At the end of this course, learners will be able to:
1. Improve their language usage in LSRW skills.
2. Develop listening skills to understand sentence stress and intonations.
3. Acquire the ability to understand different written texts.
4. Enhance the writing skills to express the ideas of the learners.
5. Communicate fluently in pair / team.

Unit I	LANGUAGE FOCUS	9

Voice(Active & Passive) - Reported speech - Conditionals - Collocations - Discourse markers - One word substitution - Phrasal verbs - Error identification

Unit II	LISTENING	9

Listening for specific information – Identifying sentence stress - Rhythm - Intonation

Unit III	READING	9

Reading graphs and charts - Skimming and scanning texts – Identifying topic sentences - Understanding the structure of a text

Unit IV	WRITING	9

Job Application, Letter and Resume - Recommendations - Report writing (accident and survey) - Writing review (book and movie) - Transcoding (interpreting charts & diagrams)

Unit V	SPEAKING	9

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Language Functions: suggesting - comparing and contrasting - Expressing - finding out facts, attitudes and opinions

TEXT BOOK(S):

1.	Communicative English by KN Shoba ,Lourdes Joavani Rayen Published by Cambridge university Revised Edition 2018

REFERENCE(S):

1	Jeremy Comfort, Pamela Rogerson, Trish Stott, and Derek Utley, Speaking Effectively and Developing Speaking Skills for Business English, Cambridge: Cambridge University Press, 2002.
2	Eric H. Glendinning and Beverly Holmstrom, Study Reading: A Course In Reading for Academic Purposes. United Kingdom: Cambridge University Press, 2004.
3	Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For Intermediate learners Of English .Ived. United Kingdom: Cambridge University Press. 2012.
4	Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.

Department	ENGLISH					R 2019	Semester	I
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX202	HINDI	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- To help students to acquire the basics of Hindi
- To teach them how to converse in Hindi on various occasions
  - To help learners acquire the ability to understand a simple technical text in Hindi

Course Outcomes: At the end of this course, learners will be able to:
1. An ability to communicate effectively with: (a) Improved fluency in Hindi (b) Clarity on the basic sounds of the Hindi language (c) Proper vocabulary

Unit I	HINDI ALPHABET	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises. Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu&Visarg -Table of Alphabet -Vocabulary.

Unit II	NOUNS IN HINDI	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises.

Unit III	PRONOUNS AND TENSES	9

Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

Unit IV	CLASSIFIED VOCABULARY	9

Parts of body - Relatives - Spices- Eatables- Fruit & Vegetables - Clothes - Directions-Seasons - Professions.

Unit V	SPEAKING	9

Model Sentences - Speaking practice for various occasions.

TEXT BOOK(S):

1.	Elementary Hindi: Learn to Communicate in Everyday Situations by Richard Delacy Tuttle Publication 2013
2	Colloquial Hindi: The Complete Course for Beginners by Tej K. Bhatia

REFERENCE(S):

1	B. R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi, 2009
2	Syed, PrayojanMulak Hindi, RahamathullahVaniPrakasan, New Delhi, 2002.
3	Ramdev, VyakaranPradeep, SaraswathiPrakasan, Varanasi, 2004.

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Department	ENGLISH					R 2019	Semester	I
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX203	JAPANESE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- • To help students acquire the basics of Japanese language
- • To teach them how to converse in Japanese in various occasions
- • To teach the students the Japanese cultural facets and social etiquette

Course Outcomes: At the end of this course, learners will be able to communicate effectively with:

1. Improved fluency in Japanese
2. Clarity on the basic sounds of the Japanese language
3. Proper vocabulary

Unit I	Introduction	9

Introduction to Japanese - Japanese script - Pronunciation of Japanese(Hiragana) - Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions Numerals. N1 wa N2 des - N1 wa N2 ja arimasen - S ka - N1mo - N1 no N2 - .san - Kanji - Technical Japanese Vocabulary (25 Numbers) - Phonetic and semantic resemblances between Tamil and Japanese

Unit II	Vocabulary & Grammar 語彙と文法	9

Introduction - Kore - Sore - are - Kono N1 - Sono N1 - ano N1 - so des - so ja arimasen - S1 ka - S2 ka - N1 no N1 - so des ka ' koko - soko - asoko - kochira - sochira - achira - N1 wa N2 (Place) des - dhoko-N1 no N2 - Kanji-10 - ima-.ji-fun des - Introduction of verb - V mas - V masen - V mashitha-V masen deshitha - N1(Time) ne V - N1 kara N2 des - N1 tho N2 / S ne Kanji-10 - Technical Japanese Vocabulary (25 Numbers) - Dictionary Usage.

Unit III	Noun & Types 名詞とタイプ	9

N1(Place) ye ikimas - ki mas - kayerimasu - Dhoko ye mo ikimasen - ikimasendheshitha - N1(vehicle) de ikimasu - kimasu - kayerimasu - N1(Personal or Animal) tho V ithsu - S yo. - N1 wo V (Transitive) - N1 wo shimus - Nani wo shimasu ka - Nan & Nani - N1(Place) de V - V masen ka - V masho - Oo. Kanji-10 , N1(tool - means) de V - Word / Sentence wa go nan des ka - N1(Person) ne agemus - N1(Person) ne moraimus - mo V shimashitha - , Kanji-10 - Japanese Typewriting using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit IV	Vocabulary & Grammar 語彙と文法	9

Introduction to Adjectives - N1wanaadj des. N1 wa ii adj des - naadjna N1 - ii adj ii N1 - Thothemo - amari - N1 wadho des ka - N1 wadhonna N2 des ka - S1 ka S2 - dhore - N1 gaarimasu - wakarimasu - N1 ga suki masu - N1 gakiraimasu - jozu des - hetha des - dhonna N1 - Usages of yoku - dhaithai - thakusan - sukoshi - amari - zenzen - S1 kara S2 - dhoshithe, N1 gaarimasu - imasuN1(Place) ne N2 gaarimasu - iimasu - N1 wa N2(Place) ne arimasu - iimasu - N1(Person,Place,or Thing) no N2 (Position) - N1 ya N2, Kanji-10 - Japanese Dictionary usage using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit V	Root Word & Vocabulary 語彙と語彙	9

Saying Numbers , Counter Suffixes , Usages of Quantifiers -Interrogatives - Dhonokurai - gurai - Quantifier-(Period) ne -.kai V - Quantifier dhake / N1 dhake Kanji - Past tense of Noun sentences and na Adjective sentences - Past tense of ii-adj sentences - N1 wa N2 yoriadj des - N1 tho N2 tho Dhochiragaadj des ka and its answering method - N1 [no naka] de {nani/dhoko/dhare/ithsu} ga ichiban adj des ka - answering -N1 gahoshi des - V1 mas form dhake mas - N1 (Place) ye V masu form ne ikimasu/kimasu/kayerimasu - N1 ne V/N1 wo V - Dhokoka - Nanika - gojumo - Technical Japanese Vocabulary (25 Numbers)

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Department	ENGLISH					R 2019	Semester	I
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX204	FRENCH	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- To help students acquire the basics of French language
- To teach them how to converse in French in various occasions

Course Outcomes: At the end of this course, learners will be able to:
1. The students will become familiar with the basics of French language and start conversing in French.

Unit I	Alphabet Français	6

Alphabet Français (alphabets) - Les Accents Français (the accents in French) - aigu - grave - circonflexe - tréma cédille - écrire son nom dans le français (spellingone -sname in French) - Les noms de jours de la semaine (Days of the week)

Unit II	Numbers, month & year (Nombre, mois et année)	6

Les noms de mois de l'année (Months) - Numéro 1 à 100 (Numbers 1 to 100) GRAMMAIRE :Conjugaison

Unit III	Language Skills & Grammar (Compétences linguistiques et grammaire)	10

Moyens de transport (Transport) - Noms de Professions (Professions) - Noms d'endroits communs (Places) - Nationalités (Nationalities) ECOUTER : (Listening) Écouter I - alphabet associéà des prénoms français - Écouter et répondre PARLER (Speaking)Présntation - même /Présentez - Vous (Introducingoneself)LIRE :Lireles phrases simples

Unit IV	Grammar (et grammaire)	12

Pronoms (Pronouns) - Noms communs masculins et de femme (Common masculine and Femininenouns) - Verbes communs (Common verbs)COUTER :couter et crier les prnoms - Observer les dessins et couter les dialogues LIRE : Lire les profils d'utilisateurs d'interlingua (alter ego)PARLER :Parler de sa ville - Parler de sa profession

Unit V	Speaking & Writing (Parler et écrire)	11

Narration de son nom et l'endroit où on vit - Son âge et date de naissance - Numéro de téléphone et'dresse-Narration du temps - La France en Europe PARLER :Conversation entre deux amis - Jouer la scène ÉCOUTER :Ecouter les conversations (CD alter ego)ÉCRIRE :Écrireune carte postale

TEXT BOOK(S):

1.	Le Bon Usage by M. Grevisse Publisher- Duculot 14 edition (25 January 2001)
2	Advanced French by Monique L'Huillier, Cambridge University Press,2013

REFERENCE(S):

1	Alter ego+ Niveau a1
2	Grammaire Progressive du Français
3	Collins Easy Learning French Verbs& Practice
4	FrançaisLinguaphone
5	Françaisl.Harrisonburg: The Rosetta Stone: Fairfield Language Technologies

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	II
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES202	ADVANCED C PROGRAMMING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions , pointers and structures
- To do input/output and file handling in C
- To use Interrupts in C Programming
- To do bit level programming

Course Outcomes:

At the end of this course, learners will be able to
- Develop C applications using Arrays and Strings.
- Develop C applications using Function and Pointers.
- Develop application using structure and union.
- Design a C application using Sequential and Random access file
- Develop program using Interrupts & bit level operations

Unit I	CONSTRUCTS OF C	9

Lexical elements – Operators - data types – I/O statements – format specifications – control statements – decision making and looping

Unit II	ARRAYS & FUNCTIONS	9

Array handling in C – declaration – single dimensional arrays, two – dimensional arrays, multidimensional arrays, sorting and searching on single and two dimensional arrays. Array order reversal, array counting or histogramming, finding the maximum number in a set, removal of duplicates from an ordered array, partition an array, finding the kth-smallest element strings: Character array – string handling functions – manipulation on strings. Prototype –declaration - arguments (formal and actual) – return types – types of functions difference between built-in and user-defined functions.

Unit III	POINTERS & STRUCTURES	9

Introduction to Pointers – Pointer Arithmetic – Pointer and Arrays – Returning Pointers. Declarations - nested structures- array of structures - structure to functions - unions- difference between structure and union – Command Line arguments

Unit IV	FILES AND HANDLING SIGNALS AND PROCESSES	9

File Introduction – File Modes – Reading and Writing Files – File related functions – Reading and Writing Binary Files – Random Access Files. What is process & Threads? Types of process and threads Use of fork, vfork? Daemon process, Signals and how to handle all signals. Use of return and exit statements

Unit V	INTERRUPT PROGRAMMING	9

Working with INT86 interrupts : Accessing Primary, Secondary Storage, Accessing Printers, Keyboards, Mouse and Monitors.

TEXT BOOK(S)

1.	Brian W Kernighan, The C programming language, second edition pearson Education Asia, 2005
2.	E.Balagurusamy, C Programming, Second Edition, Tata Mcgraw Hill, 2009
3.	Yaswant Kanitkar, Let Us C, 16th Edition, BPB Publication, 2015
4.	Paul Deitel and Harvey Deitel, —C How to Program, Seventh edition, Pearson Publication.

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REFERENCE(S)	
1.	Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
2.	Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.
3.	Ivor Hortan, Instant C Programming, Wrox Press, 1995

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	II
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS204	PHYSICS FOR INFORMATION SCIENCE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is
To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, super conducting and optical properties of materials and applications of Nanomaterials in computer

Course Outcomes: At the end of this course, learners will be able:
- To acquire knowledge on basics of semiconductor physics and its applications in various devices,
- To get knowledge on magnetic properties of materials and their applications
- To gain knowledge on super conducting materials and quantum computing
- To have the necessary understanding on the functioning of optical materials for optoelectronics,
- To understand the basics of nanomaterials and carbon nanotubes.

Unit I	SEMICONDUCTOR PHYSICS	9

Introduction- types of semiconductors - Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Hall effect theory (n-type and p-type semiconductors) and its experiment- Applications- FET, MOSFET and Silicon control rectifier (qualitative treatment only).

Unit II	MAGNETIC PROPERTIES OF MATERIALS	9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- Domain Theory, Hysteresis, soft and hard magnetic materials-Ferrites-applications-magnetic recording and readout-storage of magnetic data-Tapes, Floppy disc and magnetic disk drives and GMR

Unit III	SUPER CONDUCTING MATERIALS	9

Introduction-super conducting phenomena-Properties of super conductors-Meissner effect-isotope effect-Type I & Type II super conductor, High TC super conductor-Applications of super conductor-Magnetic levitation and SQUIDS- super conducting computing-quantum computing (qualitative concepts)

Unit IV	OPTICAL MATERIALS	9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) – Excitons – Traps – Luminescence - Flourescence and phosphorescence - LCD, Optical storage device-CD ROM-DVD ROM-Blu ray-DVD RAM

Unit V	NANOELECTRONIC DEVICES	9
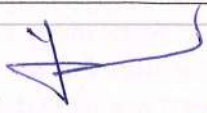
Introduction – Nanomaterials-Synthesis-physical vapour deposition-quantum confinement – quantum dot-Applications of nanomaterials- 3D printers-magnetic semiconductors– spintronics - Nanobots-Single electron transistor-DNA computing- Carbon nanotubes: preparation-Chemical Vapour Deposition technique- Properties and applications

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TEXT BOOK(S):	
1.	Jasprit Singh, —Semiconductor Devices: Basic Principlesǁ, Wiley 2012.
2.	Kasap, S.O. —Principles of Electronic Materials and Devicesǁ, McGraw-Hill Education, 2007.
3	Kittel, C. —Introduction to Solid State Physicsǁ. Wiley, 2005.
REFERENCE(S):	
1.	Garcia, N. & Damask, A. —Physics for Computer Science Students. Springer-Verlag, 2012.
2.	Hanson, G.W. —Fundamentals of Nanoelectronics. Pearson Education, 2009
3.	Rogers, B., Adams, J. & Pennathur, S. —Nanotechnology: Understanding Small Systems. CRC Press, 2014

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	II
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES205	FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- To know about the Electric circuit laws, single and three phase circuits and wiring
- To understand the Function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To understand the various measuring instruments

Course Outcomes: At the end of this course, learners will be able to:
1. Apply the concept of electric circuit laws to analyze the electric circuits.
2. Analyze the working principles of electrical machines.
3. Understand the concepts of various electronic devices.
4. Design the logic gates, Half and Full adder.
5. Choose appropriate instruments for electrical measurement for a specific application

Unit I	ELECTRICAL CIRCUITS	9

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Unit II	ELECTRICAL MECHANICS	9

Construction, Principle of Operation , Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor

Unit III	SEMICONDUCTOR DEVICES AND APPLICATIONS	9

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics

Unit IV	DIGITAL ELECTRONICS	9

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip – Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

Unit V	MEASUREMENTS & INSTRUMENTATION	9

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments – Oscilloscopes – three phase power measurements – instrument transformers (CT and PT)

TEXT BOOK(S):

1.	D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2.	Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008
3.	Leonard S Bobrow, "Foundations of Electrical Engineering", Oxfo rd University Press, 2013

REFERENCE(S):

1.	Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2.	Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006
3.	Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
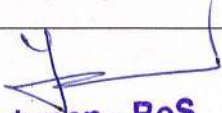
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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester II EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS02	SOFT SKILLS - II	1	0	2	2	45	100

Course Objective (s): The purpose of learning this course is

- To train the Students on Group Discussion Do's and Don'ts.
- To coach the students on Interview Skills.
- To develop Presentation Skills.
- To develop Business Etiquette.
- To teach importance of Ethics and Values.

Course Outcomes: At the end of this course, learners will be able to:

- Participate Group Discussion with Confidence by knowing the tips and Tricks.
- Attend the interview with positive attitude by having Mock Interviews.
- Present them very well by enhancing their Presentation Skills.
- Behave very well in official gathering and Meeting by knowing Etiquette.
- Have good ethics and values in their Personal and Professional Life.

UNIT 1	GROUP DISCUSSION	6

GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback.

UNIT 2	INTERVIEW SKILLS	6

Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback.

UNIT 3	PRESENTATION SKILLS	6

Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback.

UNIT 4	Business Etiquette	6

Grooming etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress.

UNIT 5	Ethics	6

Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.

PRACTICAL : 15 Hours

REFERENCES:
1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – Og Mandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi.
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	II

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES216	COMPUTER HARDWARE INSTALLATION AND SERVICING LABORATORY	0	0	2	1	30	100	

Course Objective (s):

The purpose of learning this course is

- To understand the basic concepts & structure of computer hardware & networking.
- To identify the existing configuration of the computers and peripherals.
- To apply their knowledge about computer peripherals to identify/rectify problems on board.
- To integrate the PCs into Local Area Network & re-install operating systems and various Shipboard applications.
- To perform routine maintenance and upgrades.

Course Outcomes:

At the end of this course, learners will be able to:

- Explain how a PC works, and understand the relationship between hardware and software.
- Classify and explain the function of different computer hardware components.
- Understand purpose and functions of an operating system.
- Understand the purpose and functions of the computer peripherals.
- Understand diagnostic procedures and troubleshooting techniques to personal computers, portable devices, operating systems and computer peripherals.

List of Experiments

1 Introducing Hardware & Operating Systems
2 Form Factors and Power Supplies –SMPS
3 Processors and Chipsets Motherboard types
4 PC Repair Fundamentals
5 Hard disk Partitioning and Disk Defragmentation
6 Installing Windows OS, Linux & Maintaining Windows OS, Linux
7 Upgrading Memory and Hard Drives
8 Installing and Supporting I/O Devices
9 Installing Multimedia Devices and Mass Storage
10 Installing Device Drivers – Sound, Display, Printer and Scanner Drivers
11 Install and configure the necessary components for a small peer-to-peer network for sharing files and printers.
12 Install and configure PC with internet for sharing data.
13 Securing the PC and LAN.

TEXT BOOK(S)

1.	Scott Mueller "Upgrading and Repairing PCs", 22nd Edition, QUE, Pearson Education, New Delhi, 2015.
2.	Mike Meyers, Scott Jernigan, "A+ Guide to Managing and Troubleshooting PCs", Tata McGraw Hill, 2010

REFERENCE(S)

1.	Ron Gilster, "PC Hardware – a beginner's guide" – Tata McGraw Hill, 2002
2.	Govindaraju B. "IBM PC and Clones: Hardware, Trouble Shooting and Maintenance", 2nd Edition, Tata McGraw Hill Pub. Co., New Delhi

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	II

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES215	ADVANCED C PROGRAMMING LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is

- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions , pointers and structures
- To do input/output and file handling in C
- To handle signals and Process and access peripherals

Course Outcomes:

At the end of this course, learners will be able to

- Write a C Program using basic programming constructs.
- Develop C applications using Function and Pointers.
- Develop application using structure and union.
- Design a C application using Sequential and Random access file
- Develop a C program to interact with device

List of Experiments

1. Programs using only I/O Functions
2. Programs to study operators and data types
3. Programs based on control Structures
4. Programs using For and While loops
5. Programs using single dimensional arrays
6. Programs using multi Dimensional arrays
7. Programs on Sorting and searching using arrays
8. Programs based on string Manipulations
9. Programs based on User defined function programs
10. Programs using Functions with parameters
11. Program using storage classes
12. Programs to introduce pointers
13. Programs using structures
14. Programs using array of structures
15. Program to send and receive signals
16. Program to handle process
17. Program to display device details

TEXT BOOK(S)

1,	Brian W Kernighan, The C programming language, second edition pearson Education Asia, 2005
2,	E.Balagurusamy, C Programming, Second Edition, Tata Mcgraw Hill, 2009
3.	Yaswant Kanitkar, Let Us C, 16th Edition, BPB Publication, 2015

REFERENCE(S)

1.	Paul Deitel and Harvey Deitel, —C How to Program, Seventh edition, Pearson Publication.
2.	Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
3.	Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.
4.	Ivor Hortan, Instant C Programming, Wrox Press, 1995

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	III
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS305	DISCRETE MATHEMATICS	3	2	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Understand the notion of mathematical thinking, mathematical proofs and be able to apply them in problem solving.
- Understand and use the terms Cardinality, finite, countably infinite and uncountably infinite, and determine which of these characteristics is associated with a given set.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment

Course Outcomes: At the end of this course, learners will be able to:

- Formulate short proofs using the following methods: direct proof, indirect proof and proof by contradiction.
- Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions and integers.
- Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.
- Recognize properties of graphs and its applications
- Solve Boolean functions and minimize circuits using gates.

Unit I	LOGIC AND PROOFS	12
	Propositional Logic – Applications of Propositional logic-Propositional equivalences – Predicates and Quantifiers – Nested Quantifiers – Rules of inference – Introduction to proofs	
Unit II	COUNTING	12
	The basics of counting – The pigeonhole principle – Permutations and combinations – Generating functions – Principle of Inclusion and Exclusion	
Unit III	RELATIONS	12
	Relations and their properties – n-ary Relations and their Applications- Representing relations – Closures of relations-Equivalence relations- partial orderings.	
Unit IV	GRAPHS	12
	Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths –**shortest path problems – planar graphs – graph coloring.**	
Unit V	BOOLEAN ALGEBRA	12
	Boolean functions- representing Boolean functions – logic gates-minimization of circuits.	

REFERENCE(S):	
1.	Kennath H Rosan, "Discrete Mathematics and Its Applications" Seventh Edition, Tata McGraw Hill, 2012.
2.	Ralph. P. Grimaldi,"Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, New Delhi, 2007.
3.	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", sixth edition , Pearson Education Pvt Ltd., New Delhi, 2010.
4.	Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2008.

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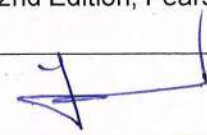
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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	III
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS301	DIGITAL ELECTRONICS	3	0	0	3	45	100	

Course Objective (s):
The purpose of learning this course is
- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

Course Outcomes:
At the end of this course, learners will be able to
- Simplify Boolean functions using KMap
- Design and Analyze Combinational and Sequential Circuits
- Implement designs using Programmable Logic Devices
- Write HDL code for combinational and Sequential Circuits

Unit I	BOOLEAN ALGEBRA AND LOGIC GATES	9

Digital Systems, Binary Numbers, Number Conversions-Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Introduction to Boolean Algebra and Logic Gates –Boolean functions - Canonical and Standard Forms-Digital Logic gates –Digital Integrated Circuits-Introduction, Special Characteristics, Different Logic Families

Unit II	GATE LEVEL MINIMIZATION	9

Introduction, The Map Method, Four Variable Map, Five Variable Map, Product of Sums Simplification, Don't Care Conditions, NAND and NOR implementation, Exclusive –OR Function, Hardware Description Language

Unit III	COMBINATIONAL LOGIC	9

Combinational circuits- Analysis and Design Procedure- Binary Adder- Subtractor- Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders- Encoders- Multiplexers- HDL for Combinational Circuits

Unit IV	SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL LOGIC	9

Sequential circuits- Latches – Flip flops – Analysis of Clocked Sequential Circuits – HDL Models for sequential CircuitsState Reduction and Assignment- Design Procedure. Asynchronous Circuits- Analysis Procedure- Circuits with Latches – Reduction of State Flow Tables – Race Free State Assignment – Hazards- Design Example.

Unit V	REGISTERS, COUNTERS AND MEMORY	9

Registers, Shift Registers, Ripple Counters, Synchronous Counters, HDL for Registers and Counters, Random access memory, Memory Decoding, Error Detection and correction, Read only Memory, Programmable Logic Array. Register Transfer Level Introduction, RTL in HDL, Algorithmic State Machines, Binary Multiplier, HDL for ASM and Binary Multiplier

TEXT BOOK(S)

1.	Malvino, Paul Albert , Leach, Donald P,GautamSaha: Digital Principles And Applications, TMH ,7th Edition, 2010.
2.	Morris Mano and Michael D. Ciletti,"Digital Design", 4th Ed.,Pearson Education, 2008

REFERENCE(S)

1.	Bartee, Thomas C: Digital Computer Fundamentals, 6th Edition, TMH.2010.
2.	Floyd, Thomas L: Digital Computer Fundamentals, 10th Edition, Pearson International. 2009.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester III	MC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19MC301	INDIAN CONSTITUTION	2	0	0	-	30	100

Course Objective (s): The purpose of learning this course is
- To Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: At the end of this course, learners will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Unit I	History of making of Indian Constitution	5

History of Indian Constitution - Drafting Committee, (Composition & Working)

Unit II	Philosophy of the Indian Constitution	5

Preamble - Salient Features

Unit III	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	5

Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.

Unit IV	ORGANS OF GOVERNANCE	5

Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.

Unit V	LOCAL ADMINISTRATION	5

District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO ZilaPachayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy.

Unit VI	ELECTION COMMISSION	5

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

TEXT BOOK(S):

1. "The Constitution of India", 1950 (Bare Act), Government Publication
2. 3. 4

2. Dr. S. N. Busi, "Dr. B. R. Ambedkar Framing of Indian Constitution", 1st Edition, 2016. Ava Publishers

3.   M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.

REFERENCE (s)

1. D.D. Basu , Introduction to the Constitution of India, Lexis Nexis, 2015.

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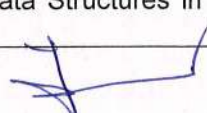
Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	III
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS302	COMPUTER ARCHITECTURE	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

To understand the basic structure and operation of a digital computer.

To understand the operation of the arithmetic unit including the algorithms & implementation of fixed point and floating-point addition, subtraction, multiplication & division.

To know in detail the different types of control and the concept of pipelining.

To know the hierarchical memory system including cache memory and virtual memory.

To know the different ways of communicating with I/O devices and standard I/O interfaces.

Course Outcomes:

At the end of this course, learners will be able to

- Design of a pipelined CPU and cache hierarchy
- Analyse and evaluate CPU and memory hierarchy performance
- Design the trade-offs in modern CPU including issues affecting superscalar and dynamically scheduled architectures
- Design hardware of multiprocessors including cache coherence and synchronization
- Design a complex simulation tool to study various micro architectural features.

Unit I	BASIC STRUCTURE OF COMPUTERS	9

Functional units - Basic operational concepts - Bus structures - Performance and metrics - Instructions and instruction sequencing - Hardware - Software Interface - Instruction set architecture - Addressing modes – RISC - CISC

Unit II	ARITHMETIC OPERATIONS	9

Arithmetic Operations - Addition and subtraction of signed numbers - Design of fast adders -Multiplication of positive numbers - Signed operand multiplication and fast multiplication - Integer division- Floating point and fixed point operations

Unit III	BASIC PROCESSING UNIT AND PIPELINING	9

Fundamental concepts - Execution of a complete instruction - Multiple bus organization - Hardwired control - Micro programmed control - Pipelining :Basic concepts - Data hazards - Instruction hazards - Data path and control considerations - Performance considerations - Exception handling - ILP –Hardware and Software approaches.

Unit IV	MEMORY SYSTEM	9

Basic concepts - Semiconductor RAM - ROM - Speed - Size and cost - Cache memories -Improving cache performance - Virtual memory - Memory management requirements - Associative memories - Secondary storage devices

Unit V	I/O ORGANIZATION	9

Accessing I/O devices - Programmed Input/output Interrupts - Direct Memory Access- Buses - Interface circuits - Standard I/O Interfaces (PCI, SCSI, and USB), IOP - CPU Communication.

TEXT BOOK(S)

1.	William Stallings, —Computer Organization and Architecture – Designing for Performancell, 8th Edition, Pearson Education, 2009.
2.	John P. Hayes, —Computer Architecture and Organization, 3rd Edition, Tata McGraw Hill, 2002.

REFERENCE(S)

1.	Carl Hamacher, Zvonko Vranesic and Safwat Zaky, —Computer Organization and Embedded Systems, 6th Edition, Tata McGraw Hill, 2002
2.	David A. Patterson and John L. Hennessy, —Computer Organization and Design: The Hardware/Software interfacell, 3rd Edition, Elsevier, 2005.
3.	V.P. Heuring, H.F. Jordan, —Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	III
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS303	OBJECT ORIENTED PROGRAMMING USING JAVA	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to
- Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the basics of Exception Handling & Multi threading
- Know how to handle events

Course Outcomes:

At the end of this course, learners will be able to:
- Write Java application programs using OOP principles and proper program structuring
- Demonstrate the concepts of Packages and inheritance
- Write Java programs to implement error handling techniques using exception handling
- Develop application using multi threading
- Write a event based java program

Unit I	INTRODUCTION TO JAVA	9

Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java

Unit II	OBJECT AND CLASSES	9

Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference.

Unit III	INHERITANCE AND PACKAGES	9

Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, Util package

Unit IV	THREADS AND EXCEPTION HANDLING	9

Thread - Thread life cycle and methods, Runnable interface, Multi threading - Thread synchronization, Exception handling with try-catch-finally – Nested try-catch – User defined Exception

Unit V	EVENT AND GUI PROGRAMMING	9

Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

TEXT BOOK(S)

1.	The Complete Reference, Java 2 (11TH Edition Edition), Herbert Schild, TMH
2.	Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education

REFERENCE(S)

1.	E. Balagurusamy, Java Programming with premier, second edition, Tata Mcgraw Hill, 2016.
2.	KEN ARNOLD, Java Programming Language, Addison Wesely, 2000
3.	John R Hubbard, Programming with Java, Tata Mcgraw Hill, 1998

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	III
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS304	DATA STRUCTURES	3	0	0	3	45	100	

Course Objective (s):
The purpose of learning this course is to
- To learn about the implementation of list using arrays and linked list
- To learn basic sorting and searching algorithms
- To design and implement stack and queue
- To study and implement the nonlinear data structures like tree and graph

Course Outcomes:
At the end of this course, learners will be able to:
- Apply the fundamental knowledge of various Data structures for designing and implementing real time problems.
- Implement basic sorting and searching algorithms.
- Write programs to implement list, linked List, stack and queue.
- Apply the concepts of trees and graphs in real world problems.

Unit I	INTRODUCTION	9

Basic terminology – classification of data structures Data structure operations – Abstract Data Types (ADT)Algorithms notations- Time complexity- Asymptotic notations Linear Array – Arrays as ADT Representation - Searching: Sequential (linear) search and Binary Search Pointer arrays – Dynamic Memory management Record structures – representation.

Unit II	LINKED LIST	9

Linked List: Representation – Singly, Doubly - Traversing– Searching- Insertion – deletion Header Linked List Circular Linked List – Two way List.

Unit III	STACK & QUEUE	9

Stack: representation – ADT Polish notations – application of stack – recursion – tower of Hanoi Queue: representation – ADT – circular queue – Dequeue – priority Queue-Application of Queues

Unit IV	TREES	9

Binary Trees: representation – traversing Traversal algorithms using stacks Binary search tree – searching – inserting – deleting AVL Trees – searching – inserting – deleting

Unit V	GRAPHS	9

Introduction – Terminology – representation Operations on Graphs Traversing : Breadth first search- Depth first search – Topological sort - Shortest-path algorithms (Dijsktra Algorithm) - Minimum spanning tree – Prim's and Kruskal's algorithms

TEXT BOOK(S)

1.	Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2011
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997

REFERENCE(S)

1.	Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983
3.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester III	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS03	QUANTITATIVE APTITUDE AND LOGICAL REASONING - I	2	0	0	0	30	100	

Course Objective (s): The purpose of learning this course is to

- Crack aptitude assessment by using speed math concepts.
- Solve problems using fast track method by learning simplification and numbers.
- Learn the basic of ratio and proportion and mixture concepts.
- Calculate different ways of solving problems on average and ages.
- Learn the logical skills by analyzing the objects.

Course Outcomes: At the end of this course, learners will be able to:

1. Solve the question with speed and accuracy.
2. Crack the quantitative aptitude questions by using simplification and numbers system.
3. Solve most of the aptitude topics by knowing ratio and proportion topics with allegation.
4. Solve the problems on average and ages by using logical way of approach.
5. Develop their logical thinking.

UNIT 1	SPEED MATHS AND NUMBER SYSTEMS	6

SPEED MATHS: Square and square roots – Square for numbers from 31 to 50. Finding squares of numbers between 81 to 100. Cubes and cubes roots.

NUMBER SYSTEMS: Numbers and types of Numbers – Properties of Numbers –Face value and place value - Divisibility rules – Concept on unit digit and remainder theorem.

UNIT 2	SIMPLIFICATIONS & PROBLEMS ON NUMBERS	6

SIMPLIFICATIONS: BODMAS rule – Application of algebraic formulae –Simplification of decimal fraction & mixed fraction – Continued fraction and its simplification – Recurring decimals.
PROBLEMS ON NUMBERS: Set of numbers – Assume the unknown numbers and form equations

UNIT 3	RATIO & PROPORTION ,ALLIGATIONS & MIXTURE	6

.**RATIO AND PROPORTION:** Ratio between two or more persons – Miscellaneous problems.
ALLIGATIONS ANS MIXTURES: Definition – Allegation rule – Mean value (or cost price) of the mixture – Six golden rules to solve problems on mixture – Removal among the quantities more than two.

UNIT 4	AVERAGES & PROBLEM ON AGES	6

AVERAGES: Average from total –Total from the average – Miscellaneous problems.

PROBLEMS ON AGES: Ages - Persons in Past - Present - Future. Miscellaneous problem.

UNIT 5	ANALOGY & MIRROR & WATER IMAGES	6

ANALOGY: Study and topic relationship – Worker and tool relationship – Tool and action relationship – Work and working place – Worker and product – Product and raw materials – Instrument and measurement – Quantity and unit – Animals and young ones – Male and female.
MIRROR IMAGES AND WATER IMAGES: Letter inverted – Object inverted.

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TOTAL : 30 HOURS

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012

2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.

3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.

4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.

5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.

6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	III

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS305	DIGITAL ELECTRONICS LABORATORY	0	0	4	2	60	100	

Course Objective (s):

The purpose of learning this course is

- To familiarize students with digital ICs, the building blocks of digital circuits
- To provide students the opportunity to set up different types of digital circuits and study their behaviour

Course Outcomes:

At the end of this course, learners will be able to

- Study and Test Logic Gates
- Implement Logic Circuits
- Design and Implement Adder and Subtractor
- Design and Implement Combinational Circuits
- Design and Implement Sequential Logic Circuit

List of Experiments

Study of Logic Gates.

a. Logic gates using discrete Components.
b. Verification of truth table for AND, OR, NOT, NAND, NOR and XOR gates.
c. Realization of NAND and NOR gates

Implementation of Logic Circuits.

d. Verification of Boolean laws.
e. Verification of DeMorgan's law

Adder and Subtractor

f. Implementation of Half-Adder and Full-Adder
g. Implementation of Half-Subtractor and FullSubtractor

Combinational Circuit Design

h. Design of Decoder and Encoder
i. Design of Code Converter.
j. Design of multiplexers and demultiplexers.

Sequential Circuit Design

k. Implementation of Shift registers, Serial Transfer.
l. Ring Counter , 4-bit Binary Counter , BCD Counter.

TEXT BOOK(S)

1.	Malvino, Paul Albert , Leach, Donald P,GautamSaha: Digital Principles And Applications, TMH ,7th Edition, 2010.
2.	Morris Mano and Michael D. Ciletti,"Digital Design", 4th Ed.,Pearson Education, 2008

REFERENCE(S)

1.	Bartee, Thomas C: Digital Computer Fundamentals, 6th Edition, TMH.2010.
2.	Floyd, Thomas L: Digital Computer Fundamentals, 10th Edition, Pearson International. 2009.

Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	III
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS306	DATA STRUCTURES LABORATORY	0	0	4	2	60	100

Course Objective (s):
The purpose of learning this course is to
- Familiarize students in the implementation of searching algorithms, sorting algorithms, linear & non linear data structures.

Course Outcomes:
At the end of this course, learners will be able to:
- Implement searching algorithms and sorting algorithms Implement Linear data structures (list, stack & queue) and non linear data structures (trees and graphs).

List of Experiments
1. Implementation of Searching Algorithms
2. Implementation of sorting algorithms
3. Implementation of LIST ADT using Array and Linked Representation
4. Implementation of Queue ADT
5. Implementation of Singly, Doubly and Circularly Linked Lists
6. Implementation of Stack ADT using Arrays and Linked list
7. Implementation of Binary Trees
8. Implementation of Graph Algorithms

TEXT BOOK(S)

1.	Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2011
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.

REFERENCE(S)

1.	Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
3.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	III
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS307	JAVA PROGRAMMING LABORATORY	0	0	4	2	60	100	

Course Objective (s):

The purpose of learning this course is to
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the basics of Exception Handling & Multi threading
- Know how to handle events

Course Outcomes:

At the end of this course, learners will be able
- To write program using object classes
- Apply inheritance and Interface to write program
- Able to handle I/O with exception handling
- Develop multi threaded program
- To develop GUI with event handling

List of Experiments

1. Programs using class and methods
2. Inheritance implementation
3. Inheritance via Interface and Abstract class
4. Programs on Package implementations
5. Applications using Generic collections
6. Program using IO Streaming
7. Create user defined exception
8. Develop application to demonstrate multi threading
9. Program using Applet with event handling
10. Program to demonstrate event handing using AWT/ Swing
11. Program to demonstrate Layout Managers
12. Program to demonstrate file handling

TEXT BOOK(S)

1.	Herbert Schildt, Java: The Complete Reference, 11th Edition, McGraw Hill Education
2.	Cay S Horstmann, Gary Cornell, Core Java Volume - I Fundamentals,9th Edition, Prentice Hall, 2013.

REFERENCE(S)

1.	Bert Bates, Kathy Sierra, Head First Java, 2nd Edition, OReilly Media, 2005.
2.	Kathy Sierra, Bert Bates, OCA/OCP Java SE 7 Programmer I and II Study Guide, First edition, McGraw Hill Education, 2014.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	IV
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS401	PROBABILITY AND STOCHASTIC MODELS	3	2	0	4	60	100

Course Objective (s): The purpose of learning this course is to

- By enrolling and studying this course the students will be able to understand the basic concepts of probability and the distributions with characteristics and also two dimensional random variables
- Summarize and apply the methodologies of the random processes and Queuing Theory.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Course Outcomes: At the end of this course, learners will be able to:

- The students will be able to demonstrate and apply the basic probability axioms and concepts in their core areas. of random phenomena in their core areas.
- The students will be able to apply the concepts of probability distributions in an appropriate place of science and Engineering.
- The students will be able to calculate the relationship of two dimensional random variables using Correlation techniques and to study the properties of two dimensional random variables
- The students will be able to apply the concepts of random processes and stationary random processes in their core areas.
- The students will be able to identify and apply the queuing methodologies to optimize the result of the waiting line.

Unit I	PROBABILITY AND RANDOM VARIABLE	12

Probability - Axioms of probability - Conditional probability - Total probability - Baye's theorem- Random variable - Probability mass function - Probability density function - Properties - Moment generating functions.

Unit II	PROBABILITY DISTRIBUTIONS	12

Moment generating functions of probability distributions- Concept and applications of standard probability distributions: Binomial- Poisson- Uniform -Exponential –Normal- Weibull distributions.

Unit III	TWO DIMENSIONAL RANDOM VARIABLES	12

Joint Distribution - Discrete and continuous distributions - Marginal and Conditional Distributions - Covariance Auto Correlation.

Unit IV	STOCHASTIC PROCESS	12

Classification- Stationary process- Markov process- Markov chains- Transition probabilities- Limiting distributions- Poisson process- Birth and death Processes
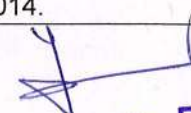
Unit V	QUEUING MODELS	12

Characteristics of Queuing models - Kendal's Notation - single and multi server Markovian queuing models M/M/1, M/M/C (finite and infinite capacity)- Pollaczek-Khinchine formula - Queuing applications
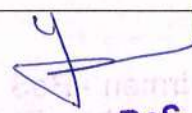
REFERENCE(S):

1. Sheldon M.Ross "Stochastic Processes" Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2008.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3. Johnson R.A, Miller & Freund's Probability and Statistics for Engineers , Pearson Education, Delhi, 2009
4. Trivedi K. S, Probability and Statistics with Reliability, Queuing and Computer Science Applications, John Wiley and Sons, Second Edition, 2012
5. Allen A.O, Probability Statistics and Queuing Theory, Academic press, New Delhi, 2014.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	IV
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS401	DESIGN AND ANALYSIS OF ALGORITHMS	3	0	0	3	45	100

Course Objective (s):
The purpose of learning this course is
- To introduce general techniques for analyzing computer algorithms
- To learn different algorithm design techniques
- To understand the limitations of Algorithm power

Course Outcomes:
At the end of this course, learners will be able to
- Recognize general principles and good algorithm design techniques for developing efficient algorithms
- Estimate the time and space complexities of algorithms
- Apply mathematical preliminaries to the analysis and design stages of different types of algorithms
- Write efficient algorithms
- Compare the time and space complexities of different types of algorithms .

Unit I	ALGORITHM ANALYSIS	9

Importance - role of algorithms in computing - Algorithm efficiency - Mathematical analysis for Recursive and Non-recursive algorithms - Empirical analysis of algorithm. Brute Force Approach: Selection Sort - Bubble Sort - Sequential Search - String Matching.

Unit II	DECREASE AND CONQUER TECHNIQUE	9

Insertion sort - Topological sort. Divide And Conquer Technique: Merge sort - Quick sort - Binary search - Strassen's Matrix Multiplication

Unit III	DYNAMIC PROGRAMMING	9

Knapsack Problem and Memory functions - Optimal Binary Search Trees - Warshall's and Floyd's Algorithms. Greedy Technique: Prims Algorithms - Kruskal's Algorithm - Dijkstra's Algorithm - Huffman Trees and Codes

Unit IV	SOLVABILITY	9

Lower Bound Arguments - Decision Trees - P, NP and NP-Complete Problems., Problem. Approximation Algorithms: Vertex-cover problem - Travelling Salesman Problem

Unit V	BACKTRACKING	9

n - Queens Problem - Hamiltonian Circuit Problem - Subset Sum Problem. Branch and Bound Technique: Assignment Problem - Knapsack Problem - Travelling Salesman

TEXT BOOK(S)

1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2017
2.	Alfred V Aho, Design And Analysis Of Computer Algorithms, Addison Wesely, 2001

REFERENCE(S)

1.	Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009
2.	Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms," 2nd Edition, Galgotia Publications, 2008.
3.	Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rd Edition, 2008.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester IV	HS
Course Code	**Course Name**	**Hours/ Week**			**Credit**	**Total Hours**	**Maximum Marks**
		L	T	P	C		
19HS402	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	2	1	0	3	60	100

Course Objective (s): The purpose of learning this course is to
- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Salient Features of the Course: The salient features this course is to
- It presents a universal approach to value education by developing the right understanding of reality (i.e. a worldview of the reality "as it is") through the process of self-exploration.
- The whole course is presented in the form of a dialogue whereby a set of proposals about various aspects of the reality are presented and the students are encouraged to self-explore the proposals by verifying them on the basis of their natural acceptance within oneself and validate experientially in living.
- The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information.
- While introducing the holistic worldview and its implications, a critical appraisal of the prevailing notions is also made to enable the students discern the difference on their own right.

Course Methodology: The methodology of this course is :
- To explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
- The course is in the form of 28 lectures (discussions) and 14 practice sessions.
- It is free from any dogma or value prescriptions.
- It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
- This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self evolution.
- This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Module 1 – Introduction to Value Education
                    6+3
Lectures - Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations
Tutorials [Practice Session] - Sharing about Oneself - Exploring Human Consciousness - Exploring Natural Acceptance

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Module 2 – Harmony in the Human Being	6+3

Lectures - Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programme to ensure self-regulation and Health

Tutorials [Practice Session] - Exploring the difference of Needs of Self and Body - Exploring Sources of Imagination in the Self - Exploring Harmony of Self with the Body

Module 3 – Harmony in the Family and Society	6+3

Lectures - Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship – 'Trust' – the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in the Society - Vision for the Universal Human Order

Tutorials [Practice Session] - Exploring the Feeling of Trust - Exploring the Feeling of Respect - Exploring Systems to fulfil Human Goal

Module 4 – Harmony in the Nature/Existence	4+2

Lectures - Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature – Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence

Tutorials [Practice Session] - Exploring the Four Orders of Nature - Exploring Co-existence in Existence

Module 5 – Implications of the Holistic Understanding	6+3

Lectures - Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models-Typical Case Studies - Strategies for Transition towards Value-based Life and Profession

Tutorials [Practice Session] - Exploring Ethical Human Conduct - Exploring Humanistic Models in Education - Exploring Steps of Transition towards Universal Human Order

Course Outcomes: At the end of this course, learners will be able to:
- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- Students would become more responsible in life, and in handling problems with sustainable solutions.
- Students become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- Students 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 .
- Students would have better critical ability .

TEXT BOOK(S):

1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-53-2

REFERENCE BOOK(S):

1.	Jeevan Vidya: EkParichaya, 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)
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

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Department	B.E. COMPUTER SCIENCE AND DESIGN					R 2019	Semester	IV
Course Code	**Course Name**	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS04	QUANTITATIVE APTITUDE AND LOGICAL REASONING - II	2	0	0	0	30	100	

Course Objective (s): The purpose of learning this course is to
- Learn the basic of partnership and chain rule in simplified way.
- Solve problems using fast track method by learning profit and loss with percentage.
- Teach the angle of elevation and depression.
- Know the relationship, direction concepts in easy way.
- Know about coding and decoding through logical way.

Course Outcomes: At the end of this course, learners will be able to:
1. Solve problems by using shortcut in partnership and chain rule.
2. Know the tips and tricks of profit and loss with percentage through fast track methods.
3. Understand the concepts of angles.
4. Evaluate critically the real life situations by resorting and analyzing analytical reasoning of key issues and factors.
5. Enhance the logical way of thinking by solving problems codes and rankings concepts.

UNIT 1	**PARTNERSHIP & CHAIN RULE**	6

PARTNERSHIP: Ratio of division of gains: Simple Partnership – Compound Partnership - Working and sleeping partners.
CHAIN RULE: Definition – Direct proportion and Indirect proportion.

UNIT 2	**PROFIT & LOSS, PERCENTAGE**	6

PROFIT AND LOSS: Basic definition and types of profit and loss – Concept of discount and marked price – Concept of true v/s false value – Application in data interpretation problems.
PERCENTAGE: Percentage – Percentage using shortcuts.

UNIT 3	**HEIGHT AND DISTANCE**	6

HEIGHT AND DISTANCES: Line of sight – Angle of elevation – Angle of depression.

UNIT 4	**BLOOD RELATIONSHIP & DIRECTION SENSE TEST**	6

BLOOD RELATIONSHIP: Analysis the gender relationship –Relationship diagram - Family tree.
DIRECTION SENSE TEST: Distance between the starting and ending points - Sense the direction correctly.

UNIT 5	**LOGICAL SEQUENCE OF WORD, CODING AND DECODING, NUMBER RANKING & TIME SEQUENCE TEST**	6

LOGICAL SEQUENCE OF WORDS: Sequence of occurrence of events – Sequence of objects in a class or group – Sequence of increasing/decreasing size, value, intensity, etc.
CODING AND DECODING: Introduction – Description of coding method, Coding patterns – Concepts of coding & decoding – Problems involving coding & decoding method.
NUMBER RANKINGS & TIME SEQUENCE TEST: Number test – Ranking test – Time sequence test.

TOTAL : 30 HOURS

REFERENCES:
1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012

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8.	Bharat Mein Angreji Raj – PanditSunderlal
9.	Rediscovering India - by Dharampal
10.	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

SUGGESTED ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation. *Example*:

Assessment by faculty mentor: 10 marks

Self-assessment: 10 marks & *Assessment by peers*: 10 marks

Socially relevant project/Group Activities/Assignments: 20 marks

Semester End Examination: 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	IV

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS403	COMPUTER NETWORKS	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

- To study the concepts of data communications and functions of different layers of ISO/OSI
- reference architecture
- To understand the error detection and correction methods and types of LAN
- To study the concepts of sub netting and routing mechanisms.
- To understand the different types of protocols and network components.
- To study the application protocols and network security

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the fundamentals of data communications and functions of layered architecture.
- Practice the error detection and correction methods and understand the different network technologies
- Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and routing technologies
- Understand the transport layer principles and reliable data transfer
- Understand the application layer protocols and also the use of cryptography and network security

Unit I	DATA COMMUNICATIONS AND PHYSICAL LAYER	9

Introduction, history and development of computer networks, networks topologies, ISO/OSI model and protocols. Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B). MAC Layer: Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA.

Unit II	DATA LINK LAYER	9

Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, LAN: Design, specifications of popular technologies, switching, Ethernet, Gigabit Ethernet, Token Ring, Token Bus, Bluetooth, Wi-Fi, Wi-Max, FDDI, PPP, bridging and SDN.

Unit III	NETWORK LAYER	9

Internet Protocol, IPv6, ARP, DHCP, ICMP, Distance vector routing, Link state routing, Classless Inter-domain routing, RIP, OSPF, BGP, Subnetting, , Network Address Translation

Unit IV	TRANSPORT LAYER	9

UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, Design issues in protocols at different layers, Socket Programming

Unit V	APPLICATION LAYER	9

DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW, symmetric and asymmetric key cryptography, Sharing of symmetric keys – Diffie-Hellman key Exchange, Public Key Infrastructure, Public Key Authentication Protocols, Firewalls.

TEXT BOOK(S)	
1.	AS Tanenbaum, DJ Wetherall, "Computer Networks", 5th Edition, Prentice-Hall, 2010.
2.	Behrouz A. Forouzan, "Data communication and Networking", 4th Edition, Tata McGrawHill, 2007

REFERENCE(S)	
1.	Peterson & Davie, "Computer Networks, A Systems Approach", 3rd Edition, Harcourt, 2013
2.	William Stallings, "Data and Computer Communications", 8th Edition, PHI, 2006

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2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.

3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.

4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.

5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018

6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester IV	EEC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HS401	LANGUAGE SKILLS	0	0	2	0	30	100

Course Objective (s): The purpose of learning this course is
- To involve the students in effective listeningactivities.
- To improve the oral communication skills in propermanner.
- To focus the effective reading of general and technicaltext.
- To enhance and comprehend the writtentext.
- To integrate LSRWskills.

Course Outcomes: At the end of this course, learners will be able to
- Understand the technicaltalks.
- Communicate to his peer groupproperly.
- Comprehend the general and technicaltext.
- Write the reports and job application in clearmanner.
- Integrate LSRWskills.

Unit I	LISTENING	6

Listening and its importance –Listening strategies - Listen to a process information - give information, as part of a simple explanation - Being an active listener: giving verbal and non-verbal feedback - taking lecture notes

Unit II	SPEAKING	6

Give personal information - ask for personal information - express ability - ask for clarification - pronunciation basics - pronunciation practice - conversation starters: Pep talk - stressing syllables and speaking clearly - summarizing academic readings and lectures

Unit III	READING	6

Strategies for effective reading - Read and recognize different types of texts - Predicting content using photos and title - Read for details - Use of graphic organizers to review and aid comprehension - Understanding pronoun reference and use of connectors in a passage- speed reading techniques

Unit IV	WRITING	6

Plan before writing - Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph – Write a paragraph with reasons and examples - Write an opinion paragraph – E-mail writing - Types of essays- descriptive-narrative- issue-based-argumentative-analytical

Unit V	INTEGRATION OF LSRW	6

Task based Instruction : watching a video –Listing, Sorting, ordering, comparing and analyzing the ideas – Reading a newspaper and creating topic based videos

TEXT BOOK(S):

1	Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2	Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011
3	Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCE(S):

1.	Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006.
2.	E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan
3.	Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	IV

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS407	DATABASE MANAGEMENT SYSTEM LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is

- To learn the fundamentals of data models to conceptualize and depict a database system using ER diagram.
- To understand the relational database implantation using SQL with effective relational database design concepts
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design along with Query optimization techniques.

Course Outcomes:

At the end of this course, learners will be able to:

- Use the Relational model, ER diagrams.
- Familiarize to use SQL commands to manage the database
- Apply concurrency control and recovery mechanisms for practical problems.
- Design effective Databases for enterprise applications

List of Experiments

1 Conceptual Database design using E-RDIAGRAM.
2 Implementation of SQL commands DDL, DML, DCL and TCL
3 Queries to demonstrate implementation of Integrity Constraints
4 Practice of In built functions
5 ImplementationofJoinoperationandNestedQueries,PracticingsetoperatorsinSQLqueries
6 Implementation of virtual tables using Views
7 PracticeofProceduralextensions(Procedure,Function,Cursors,Triggers)
8 Application Development using front end tools
a. Inventory Control System
b. Railway Reservation System
c. Bank Management System
d. Payroll Processing System
e. Hotel Management System
f. Project Management System
g. Student Information System
9 Study of MongoDB

TEXT BOOK(S)

1.	A. Silberschatz, H. F. Korth & S. Sudershan, Database systemconcepts, McGraw Hill, 6th Edition 2010.
2.	C. J. Date, An introduction to database systems, Addison Wesley,8 th Edition, 2003.

REFERENCE(S)

1.	R. Elmasri & S. B. Navathe, Fundamentals of database systems, Addison Wesley, 6th Edition, 2011.
2.	H. Garcia et al., Database system implementation, Prentice Hall,2000

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	IV
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19IT304	DATABASE MANAGEMENT SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to
- Learn data modeling using the entity-relationship and developing database designs.
- Understand the use of Structured Query Language (SQL) and learn SQL syntax.
- Apply normalization techniques to normalize the database
- Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Course Outcomes:

At the end of this course, learners will be able to
- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
- Familiar with basic database storage structures and access techniques

Unit I	INTRODUCTION	9

History and motivation for database systems; components of database systems; DBMS functions; database architecture and data independence.

Unit II	DATA MODELING	9

Data modeling; conceptual models; object -oriented model; relational data model.; Database query languages: Overview of database languages; SQL; query optimization; 4th-generation environments; embedding nonprocedural queries in a procedural language; introduction to Object Query Language.

Unit III	RELATIONAL DATABASES	9

Mapping conceptual schema to a relational schema; entity and referential integrity; relational algebra and relational calculus; Relational database design: Database design; functional dependency; normal forms; multi valued dependency; join dependency; representation theory.

Unit IV	TRANSACTION PROCESSING	9

Transactions; failure and recovery; concurrency control

Unit V	PHYSICAL DATABASE DESIGN	9

Storage and file structure; indexed files; hashed files; signature files; b -trees; files with dense index; files with variable length records; database efficiency and tuning.

TEXT BOOK(S)

1.	A. Silberschatz, H. F. Korth & S. Sudershan, Database system concepts, McGraw Hill, 6th Edition 2010.
2.	C. J. Date, An introduction to database systems, Addison Wesley,8 th Edition, 2003.

REFERENCE(S)

1.	R. Elmasri & S. B. Navathe, Fundamentals of database systems, Addison Wesley, 6th Edition, 2011.
2.	H. Garcia et al., Database system implementation, Prentice Hall,2000

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	IV
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS404	OPERATING SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is
- To understand the basic concepts of operating system.
- To familiarise the OS services that assist system users
- To expose several aspects of OS design including: process, deadlocks and File systems.CPU scheduling and Process synchronization,
- To learn the memory management, Secondary Management and File System Implementation.

Course Outcomes:

At the end of this course, learners will be able to:
- Determine the efficiency of CPU Scheduling algorithms
- Detect and model Deadlock
- Implement Process Synchronization techniques.
- Simulate disk scheduling and Memory management techniques.
- Identify File and Disk Storage Management with respect to different Storage Management

Unit I	INTRODUCTION TO OS AND PROCESS	9

Overview of operating systems-Functionalities, characteristics and types of OS Hardware concepts - CPU states, I/O channels- Memory hierarchy microprogramming –Process concepts - operations on processes – process states -Concurrent processes – process control block -Process context Threads Concepts

Unit II	CPU SCHEDULING AND SYNCHRONIZATION	9

Job and processor scheduling – scheduling algorithms –Process hierarchies Problems of concurrent processes – critical sections – mutual exclusion – synchronization – Process cooperation, producer and consumer processes – Critical section problem Semaphores – init, wait, signal operations - Use of semaphores to implement mutex, process synchronization – Critical reg.

Unit III	IPC AND DEADLOCK	9

Inter process Communication (IPC) - Message Passing– Direct and Indirect Communication Deadlock: System model – Deadlock characteristics – Methods for handling deadlocks – Deadlock prevention Deadlock avoidance - Deadlock detection - Deadlock recovery

Unit IV	MEMORY MANAGEMENT	9

Memory Management: Background - Swapping -Contiguous memory allocation – Paging - Segmentation - Segmentation with paging Virtual Memory: Background - Demand paging Process creation Page replacement -Allocation of frames –Thrashing

Unit V	FILE AND SECONDARY STORAGE MANAGEMENT	9

Secondary Storage Management – disk components - Disk scheduling – swap-space management File organization – blocking and buffering – file descriptor - Directory structure UNIX file structure Protection and Security - Access rights – access matrix

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TEXT BOOK(S)	
1.	Abraham Silberschatz, Peter B.Galvin, Greg Gagne, Operating System Concepts. Ninth edition. Addison-Wesley(2015)
2.	William Stallings, "Operating Systems-Internals and Design Principles", Sixth Edition, Pearson Prentice Hall(2009).

REFERENCE(S)	
1.	Harvey M.Deitel, Paul J. Deitel, David R. Choffnes, "Operating systems", Third edition, Pearson Prentice Hall(2007).
2.	Andrew S. Tanenbaum, Albert S. Woodhull "Operating systems: design And implementation", Third Edition, Pearson Prentice Hall (2006)

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	V
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS501	WEB TECHNOLOGY	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is To understand the basics of WWW and Web design Develop website using HTML, CSS and java scripts To develop web application using PHP & MySQL

To send and receive data using XML &AJAX

Course Outcomes:

At the end of this course, learners will be able to:

- Describe the concepts of WWW including browser and HTTP protocol.
- Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
- Use the JavaScript to develop the dynamic web pages.
- Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
- Develop the modern Web applications using the XML and AJAX

Unit I	Introduction to WWW & WEB DESIGN	6

Concept of WWW, Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0. Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

Unit II	HTML & STYLE SHEETS	9

Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Website structure. Overview and features of HTML5. Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS

Unit III	JAVA SCRIPT	9

Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and Javascript, Events and buttons

Unit IV	PHP	12

PHP : Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files,

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Advance Features: Cookies and Sessions, Object Oriented Programming with PHP. , Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin

Unit V	XML AND AJAX	9

Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT. AJAX Architecture-Dynamic web page Creation using AJAX.

TEXT BOOK(S)

1.	Steven Holzner, PHP Complete Reference, Mcgraw Hill, 2014
2.	Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson, 2017

REFERENCE(S)

1.	Developing Web Applications in PHP and AJAX, Harwani, McGraw Hill, 2017
2.	Web Technology: Theory and Practice by M. Srinivasan Publisher: Pearson India, 2017.
3.	Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India, 2014

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	V
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS502	THEORY OF COMPUTATION	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is
- To have an understanding of Computational languages.
- To have a knowledge of regular languages and context free languages and its properties.
- To know the relation between regular language, context free language and corresponding
- recognizers.
- To study the concept of Turing machines.

Course Outcomes:

At the end of this course, learners will be able to:
- Understand the concepts of Finite Automata, Regular and Context free Languages
- Design the Context free grammar and Push down automata for a context free Language
- Apply the pumping lemma properties to Regular and Context Free Languages
- Design the Turing machine for a Language.
- Understand the various classes of problems

Unit I	AUTOMATA	9

Strings, Alphabet, Language, Operations, Finite State Machine, definitions, finite automation model, acceptance of strings and languages, on deterministic finite automation, deterministic finite automation, equivalence between NFA and DFA, Conversion of NFA into DFA, minimization of FSM ,equivalence between two FSM's, Moore and Malay machines

Unit II	REGULAR EXPRESSIONS	9

Regular sets, regular expressions, identity rules, manipulation of regular expressions, equivalence between RE and FA, inter conversion, Pumping lemma, Closure properties of regular sets(proofs not required),regular grammars, right linear and left linear grammars equivalence between regular linear grammar and FA, inter conversion between RE and RG

Unit III	CONTEXT FREE GRAMMARS	9

Context free Grammars, Derivation trees, Left Most Derivations, Right Most Derivations, Ambiguity in Context-Free Grammars, Specifications of Context Free Grammars, Normal Forms, Chomsky Normal Form (CNF), Greibach Normal Form (GNF) , Pushdown automata (PDA) – Languages of a PDA - Equivalence of PDA's and CFG's.

Unit IV	TURING MACHINE	9

Definitions and Examples- Computing Partial Functions with Turing Machines – Combining Turing Machines-Variations of Turing Machines with Multitape TMs-Nondeterministic Turing Machines-Universal Turing Machines-Models of Computations, Counter machine and the Church Turing Thesis.

Unit V	CLASSES OF PROBLEMS	9

Chomsky hierarchy of languages, linear bounded automats and context sensitive language, Introduction to DCFL and DPDA,LR(O) Grammar, decidability of problems, Universal Turing

	Machine, undecidability of post's correspondence problem. Turing reducibility, definition of P and NP problems, NP complete and NP hard.

TEXT BOOK(S)

1.	J.E.Hopcroft, R.Motwani and J.D Ullman, —Introduction to Automata Theory, Languages and Computations, 3rd Edition, Pearson Education, 2011
2.	J.Martin, —Introduction to Languages and the Theory of Computation, 3rd Edition, TMH, 2007.

REFERENCE(S)

3.	H.R.Lewis and C.H.Papadimitriou, —Elements of the theory of Computation, 2nd Edition, Pearson Education/PHI, 2003
4.	Micheal Sipser, —Theory and Computation, 7th Edition, Thomson Course Technology, 2008

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	IV
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS503	SOFTWARE ENGINEERING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

- To know the fundamentals of project management activities.
- To design software using models.
- To gather knowledge on various software testing, maintenance methods
- To develop an efficient software system through good group cohesiveness.
- To verify the quality of software products

Course Outcomes:

At the end of this course, learners will be able to:

- Analyze a problem, identify and define the computing requirements appropriate to its solution.
- Design, implement and evaluate a system / computer based system process, component or program to meet desired needs
- Apply design and development principles in the construction of software systems.
- Apply testing methods for the software products
- improve the product by checking the quality of the software products

Unit I	FUNDAMENTALS OF SE AND REQUIREMENT ENGINEERING	9

Software Engineering Fundamentals; Software processes: Software life-cycle and process models; Process assessment models; Overview of Project Management activities; Software requirements and specifications: Requirements elicitation; Requirements analysis modeling techniques; Functional and nonfunctional requirements; User requirements, System requirements, requirement validation and software requirement specification document. Prototyping - Basic concepts of formal specification techniques

Unit II	SOFTWARE DESIGN	9

Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models, Architectural design- System structuring, Control models; Structured design; Object-oriented analysis and design; User interface design; Design for reuse; Design patterns;

Unit III	SOFTWARE VALIDATION AND MAINTENANCE	9

Software validation: Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections. Software evolution: Software maintenance; Characteristics of maintainable software; Reengineering; Legacy systems; Software reuse.

Unit IV	SOFTWARE PROJECT MANAGEMENT	9

Team management – Team processes, Team organization and decision -making, Roles and responsibilities in a software team, Role identification and assignment, Project tracking, Team problem resolution; Project planning and scheduling; Software measurement and estimation techniques; Risk analysis and management; Software quality assurance; Software configuration management;.

Unit V	SOFTWARE QUALITY PROCESS IMPROVEMENT	9

Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming environments; Project management tools; Requirements analysis and design modeling tools; testing tools; Configuration management tools;

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TEXT BOOK(S)	
1.	R. S. Pressman, Software Engineering, a practitioner's approach,McGraw Hill,7th Edition, 2017.
2.	Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011
REFERENCE(S)	
1.	Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
2.	Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
3.	Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester V	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS05	QUANTITATIVE APTITUDE AND LOGICAL REASONING - III	2	0	0	0	30	100

Course Objective (s): The purpose of learning this course is to

- Design to help people make sense of numerical data.
- Calculate the calendars and series in simplified way.
- Understand the concept of the interest amount in SI and CI.
- Know the procedure to deal with a situation and sufficient to determine the answer.
- Teach seating arrangements in rows or in small groups.

Course Outcomes: At the end of this course, learners will be able to:

1. Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken to solve Aptitude Questions.
2. Solve the question based on calendar, odd man out and series by using shortcut methods.
3. Calculate the interest by using shortcut methods instead of traditional methods.
4. Induce their critical thinking by solving the syllogism and course of action.
5. Analyze the conditions and do interpretation.

UNIT 1	DATA INTERPRETATION & CLOCKS	6

DATA INTERPRETATION: Tabulation – Bar graphs – Pie charts – Line graphs.
CLOCKS: Definition – important points – Angular difference between two hands at different timings-Incorrect clock.

UNIT 2	CALENDARS, ODDMAN OUT & SERIES	6

CALENDARS: Odd days – Leap year – Ordinary year – Counting of odd days – Day of the week.

ODDMAN OUT & SERIES: Odd man out – Power series – Number series-Sequence of real numbers.

UNIT 3	SIMPLE & COMPOUND INTEREST	6

SIMPLE INTEREST: Principal – Rate of interest – Number of years – Using formulae and shortcuts methods.
COMPOUND INTEREST: Compounded Annually – Compounded Half-Yearly – Compounded Quarterly – Compounded annually – Rates are different for different years.

UNIT 4	STATEMENT & COURSE OF ACTION, SYLLOGISM	6

STATEMENT AND COURSE OF ACTION: Courses of action - Decision taken - Improvement, Follow-up or further action in regard to the given statement.
SYLLOGISM/ LOGICAL VENN DIAGRAMS: Relationship between the two things or not - Classification of propositions – Immediate deductive inference – Immediate deductive inference.

UNIT 5	SEATING ARRANGEMENTS & DATA SUFFICIENCY	6

SEATING ARRANGEMENTS: Persons seating in the circular – Rectangular – Square.
DATA SUFFICIENCY: Reasoning ability using a set of directions.

<div align="right">**TOTAL : 30 HOURS**</div>

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012

2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.

3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.

4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.

5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.

6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	V
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS504	MOBILE APPS DEVELOPMENT – SUPPORTED BY INFOSYS LIMITED	2	0	4	2	60	100	

Course Objective (s):

The purpose of learning this course is to
- Understand Mobility landscape & Aspects of Mobile Apps Development
- Study Design and Develop of Mobile Apps
- Understand Mobile apps deployment

Course Outcomes:

At the end of this course, learners will be able to:
- Appreciate the Mobility landscape
- Familiarize with Mobile apps development aspects
- Design and develop mobile apps, using Android as development platform, with key focus on user experience design, native data handling and background tasks and notifications.
- Appreciation of nuances such as native hardware play, location awareness, graphics, and multimedia.
- Perform testing, signing, packaging and distribution of mobile apps

Unit I	Getting started with Mobility	6

Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development

Unit II	Building blocks of mobile apps	15

App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities.

App functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs

Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet)

Unit III	Sprucing up mobile apps	8

Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)

Unit IV	Testing mobile apps	5

Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, MonkeyTalk

Unit V	Taking apps to Market	9

Versioning, signing and packaging mobile apps, distributing apps on mobile market place

Practical
- Understand the app idea and design user interface/wireframes of mobile app
- Set up the mobile app development environment
- Develop and debug mobile app components – User interface, services, notifications, broadcast receivers, data components

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- Using emulator to deploy and run mobile apps
- Testing mobile app - unit testing, black box testing and test automation

TEXT BOOK(S)	
1.	Anubhav Pradhan, Anil V Deshpande, Mobile Apps Development, Edition 1
2.	Barry Burd, Android Application Development All in one for Dummies, Edition: I

REFERENCE(S)	
1	Teach Yourself Android Application Development In 24 Hours , SAMS Publications

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	V
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS505	WEB TECHNOLOGY LABORATORY	0	0	4	2	60	100

Course Objective (s):
- The purpose of learning this course is to
- Understand various Scripts like HTML, XML and JavaScript
- Study the various rich internet applications using Ajax
- Learn the server side programming using PHP

Course Outcomes:
At the end of this course, learners will be able to:
- Build interactive web applications using HTML, DHTML and CSS
- Design dynamic web pages using AJAX, PHP and XML
- Implement the web authoring tools with the database design for web development

List of Experiments

1. Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject

2. Design HTML form for keeping student record and validate it using Java script.

3. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.

4. Write programs using Java script for Web Page to display browsers information.

5. Write a Java applet to display the Application Program screen i.e. calculator and other.

6. Writing program in XML for creation of DTD, which specifies set of rules. Create a style sheet in CSS/ XSL & display the document in internet explorer.

7. Program to illustrate JDBC connectivity. Program for maintaining database by sending queries. Design and implement a simple servlet book query with the help of JDBC & SQL. Create MS Access Database,.

8. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.

9. Install a database (MySQL or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a PHP to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.

10. Write a PHP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database

11. Design and implement a simple shopping cart example with session tracking API.

TEXT BOOK(S)

1.	HTML 5, Black Book, dreamtech Press, 2017
2.	Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson, 2017
3.	Developing Web Applications in PHP and AJAX, Harwani, McGraw Hill 2015

REFERENCE(S)

| 1. | Web Technology: Theory and Practice by M. Srinivasan Publisher: Pearson India, 2016 |
| 2. | Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India, 2017 |

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester V	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HS504	PROFESSIONAL SKILLS FOR SOFTWARE ENGINEER	0	0	2	0	30	100	

Course Objective (s):
- To develop students' communicative competence in English with Listeningskills.
- To improve their ability to communicate effectively in interviews.
- To enable the learners to fine-tune their comprehending level of differenttexts.
- To prepare the error-freedocuments.
- To strengthen their thinking level and update their knowledge for careergrowth.

Course Outcomes: At the end of this course, learners will be able to
- Develop listening skills to comprehend general / technicaltalks.
- Make effective presentations in group/pair and attend jobinterviews
- Understand various concepts by reading differenttexts.
- Enhance the writing skills to express the ideas of thelearners.
- Strengthen their softskills.

Unit I	LISTENING	6

Formal and Informal conversation - Practicing Group discussion & Presenting Ideas, Listening interviews conversations, News, documentaries - Listening to Seminars, discussions from TV/ Radio/ Podcast

Unit II	PUBLIC SPEAKING	6

Introduction to Group Discussion – Guidelines to GD – GD Best Practices - Participating in group discussions - Understanding group dynamics - Different types of Interview format - answering questions - offering information - Mock interviews – Improving Body language (paralinguistic features) - Articulation of sounds - Intonation - Making effective presentations

Unit III	ACADEMIC READING	6

Reading different genres ranging from daily newspapers, technical articles, magazines and short stories - Predicting the content - Gap filling exercises - Sequencing the sentences

Unit IV	WRITING SKILLS	6

Writing Job applications - Resume preparation - E-mail content writing – Technical Content Presentation in web - Letters(formal & informal) - Memos - Reports - Interpreting the visual texts – Common Errors in English - Preparation of Essays

Unit V	IT CAREER SKILLS	6

Introduction to Employability and IT Career Skills - developing a long term career plan - making career changes - Time Management during interview and work - General awareness of Current Affairs - Managing changes - Stress management - Leadership traits - Team work - Intercultural communication
- Creative and Critical thinking

TEXT BOOK(S):

1	E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015

REFERENCE(S):

1	Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2	Interact English Lab Manual for Undergraduate Students, OrientBalckSwan: Hyderabad, 2016.
3	Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
4	S. Hariharan etal. Soft Skills. MJP Publishers: Chennai, 2010

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VI
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS601	CRYPTOGRAPHY AND NETWORK SECRUITY	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory
- To understand authentication and Hash functions.
- To know the network security tools and applications.
- To understand the system level security used.

Course Outcomes:

At the end of this course, learners will be able

- To design and conduct experiments to analyze and interpret data.
- To use Cryptography in different fields of Engineering and Mathematics.
- To analyze and select a suitable Cipher for an application.
- To use the best solution for a threat.
- To use efficient algorithms for obtaining optimal solutions for a problem.

Unit I	INTRODUCTION TO CRYPTOGRAPHY	9

Basic concepts: confidentiality, integrity, availability, security policies, security mechanisms, assurance -Basic cryptography Historical background Transposition/Substitution, Caesar Cipher Introduction to Symmetric crypto primitives, Asymmetric crypto primitives

Unit II	SYMMETRIC CIPHERS	9

Traditional Symmetric ciphers - Substitution ciphers - Transposition ciphers - stream and block ciphers. Modern Symmetric key ciphers - Modern block and Stream ciphers - Data Encryption Standard - DES analysis - Structure - Multiple DES - Advanced data Encryption Standard - Transformation - Key Expansion – Analysis - Modern Block Ciphers - Stream Ciphers - other issues

Unit III	ASYMMETRIC CIPHERS	9

Mathematics of cryptography - Primality testing - factorization - Chinese remainder theorem - Quadratic congruence - exponentiation and logarithm - RSA Cryptosystem - Rabin Cryptosystem - Elgamal Cryptosystem - Elliptic cryptosystem

Unit IV	MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION	9

Message integrity and Message authentication - Cryptographic hash functions - Digital signature - Key management - private and public - distribution - Kerberos - PGP - Security at application layer -Transport layer - Network layer - IKE-ISAKMP

Unit V	ADVANCED NETWORK SECURITY	9

Security in GSM - Security in 3G - Security in Java and .Net - Operating Systems - Network Security -firewalls and VPN - Case studies - Single Sign On (SSO) - Denial of service (DoS) - Cross Site Scripting Vulnerability (CSSV).

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TEXT BOOK(S)	
1.	William Stallings, —Cryptography and Network security, Pearson Education, New Delhi 2007.
2.	Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., 2nd Edition, New Delhi 2009

REFERENCE(S)	
1.	Behrouz A.Forouzan —Cryptography and Network Secuity, The McGraw-Hill Companies, 2007.
2.	Roberta Bragg, Mark Rhodes- Ousley, Keith Strassberg —Network Security: The Complete Referencell, Tata McGraw-Hill, 2008
3.	Charlie Kaufman, Radia Perlman, and Mike Speciner, —Network Security: PRIVATE Communication in a PUBLIC Worldll, Prentice Hall. 2007

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VI
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS602	COMPILER DESIGN	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

- To understand, design and implement a lexical analyzer and parser.
- To design DFA & NFA with different conversion techniques.
- To implement code generation schemes.
- To perform optimization of codes and gain knowledge about runtime environments.
- To Understand Lex and YACC tools.

Course Outcomes:

At the end of this course, learners will be able to:

- Design a lexical analyzer to identify the tokens in a program
- Construct a parser through the application of grammar.
- Understand intermediate code generation and symbol table organization techniques
- Design a compiler for a small language with code generation.
- Analyze various code optimization techniques

Unit I	COMPILATION AND LEXICAL ANALYSIS	9

. Introduction to programming language translators, classification of programming languages, overview of various programming language translators, Compiler Vs Interpreter, cross compiler, bootstrap arrangement, logical phases of compiler, pass Vs phase-cousins of compilers, Lexical Analysis phase: - Design issues, patterns, lexemes, Tokens-attributes- specification of tokens, Regular expressions-Overview of automata, Thompson construction NFA-DFA-minimized DFA-lexical errors- Lex

Unit II	SYNTAX ANALYSIS	9

Role of parser- Formal definition of grammars; BNF and EBNF -Parse Tree- Ambiguity-Elimination of ambiguity- Top down parsing: Recursive-Descent parsing, Non- recursive predictive parsing; LL(1) grammars, Bottom-Up parsing:- Shift-Reduce parsers, Operating precedence parsing: design of operator precedence table, parsing –LR parsers:- Construction of SLR parser tables and parsing , CLR parsing-LALR parsing- Syntax errors-YACC

Unit III	SEMANTICS & RUNTIME ENVIRONMENTS	9

Syntax Directed Translations: Syntax-directed definitions, Translation Schemes, construction of syntax trees, DAG'S- bottom-up evaluation of s-attributed definitions, I-attributed definitions; Run-time environments: Source language issues, storage organization, storage-allocation strategies, symbol tables: local and global symbol table structures and management. Type checking Systems: Data type as set of values with set of operations; data types; type checking models; semantic models of user -defined types; parametric polymorphism; subtype polymorphism; type-checking algorithms.

Unit IV	INTERMEDIATE CODE GENERATION & OPTIMIZATION	9

Intermediate languages, Three Address code: declarations, assignment statements, addressing array el ements, Boolean expressions, case statements, back patching. Code optimization: The principle source of optimization, optimization of basic blocks, Loop optimizations

Unit V	CODE GENERATION & OTHER TRANSLATIONS ISSUES	9

Issues in the design of a code generator, the target machine, Reducing the memory access times by exploiting addressing modes- peephole optimizations, basic blocks, DAG's- Iterative vs. recursive interpretation; Elements of Assembly language- assemblers- Passes of an assembler-Macros- design of macro processors- passes of a macro processor

TEXT BOOK(S)

1.	A. V. Aho et al, Compilers: Principles, techniques, & tools, Second Edition,Pearson Education, 2007
2.	K. D. Cooper and L. Torczon, Engineering a compiler, Morgan Kaufmann, 2004

REFERENCE(S)

3.	Steven S.Muchnick "Advanced Compiler design implementation" Elsevier Science India.
4.	D.M. Dhamdhere "Systems programming and operating systems" Tata McGraw- Hill Pub.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VI

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS603	FOUNDATIONS OF INTERNET OF THINGS	2	0	2	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand what Internet of Things is.
- To identify the various elements of an IoT System
- To understand the various means of communication from Node / Gateway to Cloud Platforms
- To understand Cloud Computing & its relevance in IoT
- To identify types of data analytics and data visualization tools
- To make students aware of security concerns and challenges while implementing IoT solutions

Course Outcomes:

At the end of this course, learners will be able to:

- Describe components of IoT Architecture and platforms of IoT ecosystem
- Describe and choose Sensors and Actuators
- Describe and implement edge network
- Describe Big Data Analytics, transform data and draw meaningful conclusions
- Identify the DIY (Do it yourself) open source electronics platforms for building IoT prototypes

Unit I	Introduction to IoT	7

Definition of IoT - Evolution of IoT - IoT and related terms - Business Scope

Unit II	Elements of IoT	7

Introduction to Elements of IoT - Basic Architecture of an IoT Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA

Unit III	Communication and Connectivity Technologies	8

Cloud Computing in IoT - IoT Communication Model – Cloud Connectivity

Unit IV	Data Analytics and IoT Platforms	8

Big Data Analytics - Data Visualization - IoT Platforms

Unit V	Concerns and Future Trends	7

Different Players of IoT - Security Concerns and Challenges - Future Trends – Standards

Hands-On Projects (8 Hours)
DIY Kits - IFTTT and other apps

TEXT BOOK(S)

1.	Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Applications and Protocols, Wiley publications. Oliver
2.	Dieter Uckelmann, Mark Harrison, Florian Michahelles, Architecting the Internet of Things, Springer publications.
3.	Marco Schwatrz, Internet of Things with Arduino Cookbook, Packt Publications.

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REFERENCE(S)

4.	Internet of Things and Data Analytics, Wiley Publications

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VII

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS604	CLOUD COMUTING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the concept of cloud computing.
- To know about the cloud services .
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm and web based communication.

Course Outcomes:

At the end of this course, learners will be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud,
- service and delivery models.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

Unit I	UNDERSTANDING CLOUD COMPUTING	9

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

Unit II	DEVELOPING CLOUD SERVICES	9

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds

Unit III	CLOUD COMPUTING FOR EVERYONE	9

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

Unit IV	USING CLOUD SERVICES	9

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files

Unit V	ADVANCED WAY TO COLLABORATE ONLINE	9

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

TEXT BOOK(S)

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1.	Michael Miller, Cloud Computing, 9th Edition Pearson Education, 2014
2.	Anthony T.Velte, Cloud Computing, 12th Edition, Tata Mcgraw Hill, 2013

REFERENCE(S)

1.	Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing,
2.	Applications and Data Centers in the Cloud with SLAs, Emereo Pvt Limited, July 2008

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS06	QUANTITATIVE APTITUDE AND LOGICAL REASONING - IV	2	0	0	0	30	100

Course Objective (s): The purpose of learning this course is to

- Ascertains the occurrence of an event on the basis of already present information.
- Use area models to represent the distributive property in mathematical reasoning.
- Calculate the work capacity by chocolate based method.
- Work with time, speed and distance by relative speed concepts.
- Determine how various phenomena are related.

Course Outcomes: At the end of this course, learners will be able to

- Know the outcome of an event developed the concept of probability.
- Calculate the area and surface volume in real time application.
- Understand the concepts of Times and Work and Pipes and Cistern and Correlating the Concepts of both.
- Know the concepts of Time, Speed and Distance and concepts of Boats and Streams.
- Analyze the cause and effect of problems by using critical thinking.

UNIT 1	PROBABILITY , PERMUTATIONS & COMBINATIONS	6

PROBABILITY: Rolling an unbiased dice – Tossing a fair coin – Drawing a card from a pack of well shuffled cards – Picking up balls of certain color from a bag containing balls of different colors.
PERMUTATIONS: Numbers with digits - Words with letters - Arrangements of person in a row - Arrangements of books on a shelf.
COMBINATIONS: Formation of committee – Selection of questions from question papers.

UNIT 2	AREA & VOLUME	6

AREA: Area – Perimeter – Important points about triangle – Quadrilateral – Fast track techniques.
VOLUME: Cuboids – Cube – Cylinder – Cone – Frustum of a cone – Sphere – Hemisphere – Pyramid – their formulas.

UNIT 3	TIME & WORK, PIPE & CISTERNS	6

TIME AND WORK: Introduction – Basic concepts – Leaving and joining – Alternative days – In between days the works starting and ending.
PIPES AND CISTERNS: Introduction - Basic concepts – Capacity of the total liters –Water flow in the tank.

UNIT 4	TIME& DISTANCE, TRAINS, BOATS AND STREAMS	6

TIME AND DISTANCE: Definition – Average speed – Distance covered is same – Distance covered is different – Stoppage time per hour for a train – Time taken with two different modes of transport – Time and distance between two moving bodies.
PROBLEMS ON TRAINS: Basic concepts – Basic formulae – Different types of objects –Two trains crossing each other in both directions – Shortcuts.
BOATS AND STREAMS: Introduction – Speed of man (boat and streams) - Moving same and opposite directions – important formulae.

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UNIT 5	STATEMENT - CONCLUSION , ARGUMENTS, CAUSE & EFFECT, ASSERTION & REASON	6

STATEMENT AND CONCLUSION: Statement to be true - Two conclusions together - Logically follows.
STATEMENT AND ARGUMENTS: Arguments strong with respect to the statement.
CAUSE AND EFFECT: Cause and effect relationship between the two statements.
ASSERTION AND REASON: Assertion(A) and Reason(R) – Both (A) and (R) are individually true and (R) - (A) is true but (R) is false – (A) is false but (R) is true.

TOTAL : 30 HOURS

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012

2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.

3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.

4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.

5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.

6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS605	NETWORK SECURITY LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory
- To understand authentication and Hash functions.
- To know the network security tools and applications.

Course Outcomes:

At the end of this course, learners will be able to:

- Develop code for classical Encryption Techniques to solve the problems.
- Build cryptosystems by applying symmetric and public key encryption algorithms
- Construct code for authentication algorithms.
- Develop a signature scheme using Digital signature standard.
- Demonstrate the network security system using open source tools

List of Experiments

1. Perform encryption, decryption using the following substitution techniques
(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Implement the SIGNATURE SCHEME - Digital Signature Standard.
8. Demonstrate intrusion detection system (ids) using any tool eg. 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

REFERENCE(S)

1.	Build Your Own Security Lab, Michael Gregg, Wiley India, 2015

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS606	COMPREHENSIVE REVIEW	0	0	2	0	30	-

Course Objective (s): The purpose of learning this course is
- To encourage the students to comprehend the knowledge acquired from the first Semester to fifth Semester of B.E Degree Course through periodic exercise.

Course Outcomes: At the end of this course, learners will be able to:
- Ability to review, prepare and present technological developments

METHOD OF EVALUATION:
- The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester VII	PC

Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS701	BIGDATA ANALYTICS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the basics of Bigdata
- Learn about the basic Principles of Hadoop
- Understand features of NOSQL databases
- To explore Hadoop Eco system tools and practices for working with big data
- Know the basic R Programming

Course Outcomes: At the end of this course, learners will be able to:
- Understand basic of Big Data and its Environment
- Develop Map-Reduce application using Hadoop
- Work with NoSQL Database Management Systems
- Use Hadoop Eco System Tools for Big Data Analytics
- Analyze data using R Programming

Unit I	INTRODUCTION TO BIGDATA	6

Introduction to Big Data: Types of Digital Data-Characteristics of Data – Evolution of Big Data – Definition of Big Data – Challenges with Big Data – 3Vs of Big Data – Non Definitional traits of Big Data – Business Intelligence vs. Big Data – Data warehouse and Hadoop environment – Coexistence. Big Data Analytics: Classification of analytics – Data Science – Terminologies in Big Data – CAP Theorem – BASE Concept. NoSQL: Types of Databases – Advantages – NewSQL – SQL vs. NOSQL vs NewSQL.

Unit II	INTRODUCTION TO HADOOP	7

Introduction to Hadoop: Features – Advantages – Versions – Overview of Hadoop Eco systems – Hadoop distributions – Hadoop vs. SQL – RDBMS vs. Hadoop – Hadoop Components – Architecture – HDFS – Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression. Hadoop 2 (YARN): Architecture – Interacting with Hadoop Eco systems

Unit III	NOSQL DATABASES	9
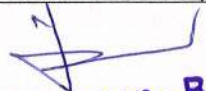
No SQL databases: Mongo DB: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors – Indexes – Mongo Import – Mongo Export. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables.

Unit IV	HADOOP ECO SYSTEMS	9

Hadoop Eco systems: Hive – Architecture – data type – File format – HQL – SerDe – User defined functions – Pig: Features – Anatomy – Pig on Hadoop – Pig Philosophy – Pig Latin overview – Data types – Running pig – Execution modes of Pig – HDFS commands – Relational operators – Eval Functions – Complex data type – Piggy Bank – User defined Functions – Parameter substitution – Diagnostic operator. Jasper Report: Introduction – Connecting to Mongo DB – Connecting to Cassandra

Unit V	R PROGRAMMING	14

Introduction – R environmental setup – Installation – RStudio – Programming with R – R as a calculator – Dealing with Missing Values – Using R Packages – Expression Data Types – Data Structures – Control Structures – Functions – Lazy Evaluation – Recursive Functions Creating a R Markdown – YAML – Markdown language – R Code in Markdown documents – Data Manipulation - Data Import

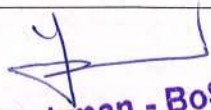Chairman - BoS
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and Export – Manipulation data with dplyr – Vectorizing Functions – Apply Family – Infix operator Replacement Functions – Function with arguments r& return – Filter, Map and Reduce

TEXT BOOK(S):	
1.	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
2	Garrett Grolemund, "Hands-On Programming with R" , O'Reilly Media, Inc, 2014.

REFERENCES	
1.	Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013
2.	Tom White, "Hadoop: The Definitive Guide", O'Reilly Publications, 2011.
3	Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.
4	Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester VII	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS702	ARTIFICIAL INTELLIGENCE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand fundamental concepts in Artificial Intelligence.
- Study searching techniques to solve real world problems
- Understand the knowledge representation and reasoning mechanisms
- Introduce machine learning models
- To know about the various applications of AI.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the basics of AI & Intelligent Agents
- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Utilize the learning model to model machines
- Design applications that use Artificial Intelligence

Unit I	INTRODUCTION TO AI	9

What is AI? – Foundations of AI – History – Applications – Agents and Environment – Rationality – Task Environment – Structure of Agents : Agent Programs – reflex agents – Model based – Goal based – Utility based – Learning Agents – Working Principles of Agent Framework

Unit II	PROBLEM SOLVING APPROACHS	9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

Unit III	KNOWLEDGE REPRESENTATION	9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

Unit IV	LEARNING	9

Forms of Learning – Supervised Learning – Learning Decision Trees – Choosing Hypothesis - Theory of Learning - Regression and Classification – Artificial Neural Networks – Support Vector Machines – Ensemble Learning – Practical Machine Learning : Case Study

Unit V	APPLICATIONS	14

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

TEXT BOOK(S):

1. S. Russell and P. Norvig,‖Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.

2. Rajendra Akerkar, "Introduction to Artificial Intelligence", PHI Learning Private Limited, 2012.

REFERENCES

1. Richard E Neapolitan, "Artificial Intelligence: With an Introduction to Machine Learning", CRC Press, Second Edition, 2018.
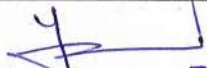
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2.	Nils J. Nilsson, —The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
3	Vinod Chandra S.S., Anand Hareendran S., "Artificial Intelligence And Machine Learning", PHI Learning Private Limited,2014

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester VII	ES
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES701	RESEARCH METHODOLOGY	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to
- Know the basics of Research formulation and Design
- Analyze data
- Learn Soft Computing Algorithms
- Knowledge on Ethics and IPR
- Knowledge on Prepare reports

Course Outcomes:

At the end of this course, learners will be able to:
- Understand basics of research formulation and design
- Collect and analyze data
- Implement soft computing algorithm
- Understand ethics and IPR
- Prepare reports

Unit I	RESEARCH FORMULATION AND DESIGN	9

Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

Unit II	DATA COLLECTION AND ANALYSIS	9

Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools,data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.

Unit III	THREE PHASE INDUCTION MACHINES	9

Computer and its role in research, Use of statistical software SPSS, GRETL etcin research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems

Unit IV	RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING	9

Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

Unit V	INTERPRETATION AND REPORT WRITING	9

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral presentation, Mechanics of writing a Research Report,T ypes of report, Oral Presentation, Mechanics of writing a Research Report, Precaution for writing Research Report, Conclusion.

TEXT BOOK(S):

1.	Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2.	Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3.	Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.

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4	Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

REFERENCES:

1	Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2	Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications

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Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS704	DATA ANALYTICS LABORATORY	0	0	4	2	60	100

Course Objective (s): The purpose of learning this course is to

- Understand the basics of Hadoop and Map Reduce Programming
- Understand Installation of Hive and Query Processing using Hive
- Learn the basics of Pig Scripts
- Understand the basic data analytics using R

Course Outcomes: At the end of this course, learners will be able to:
- Develop Map Reduce Programming
- Understand setting up of Hive and perform query processing
- Run Pig Interactive Shell Command
- Design Data Analytics applications using R,
- Visualize Data Using R.

LIST OF EXPERIMENTS

1. Installation and configuration of Hadoop
2. Map Reduce Programming
3. Perform various HDFS commands
4. Unstructured data into NoSQL data and do all operations such as NoSQL query with API
5. Perform query processing on data warehousing after successful installation of "Hive"
6. Understand data pipeline using Pig Interactive Shell Commands
7. Simple Data Analysis using MongoDB
8. Data manipulations using R
9. Load and Explore the Data
10. Chi-Square Test for Independence R
11. Linear or Logistic Regression using R
12. Histograms and Boxplots using R

TEXT BOOK(S)

1.	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
2	Garrett Grolemund, "Hands-On Programming with R" , O'Reilly Media, Inc, 2014.

REFERENCES

1.	Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013
2.	Tom White, "Hadoop: The Definitive Guide", O'Reilly Publications, 2011.
3	Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.
4	Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.

Department	COMPUTER SCIENCE AND ENGINEERING		R 2019	Semester	VII
Course Code	Course Name	Hours / Week	Credit	Total Hours	Maximum Marks

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Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS703	CLOUD COMPUTING LABORATORY	0	0	4	2	60	100

Course Objective (s): The purpose of learning this course is to

- Develop web applications in cloud
- Learn the design and development process involved in creating a cloud-based application
- Learn to implement and use Yahoo Pipes and AWS

Course Outcomes: At the end of this course, learners will be able to:

- Configure various virtualization tools such as Virtual Box, VMware workstation.
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Use AWS and Yahoo Pipes

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top
2. of windows7 or 8.
3. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
4. Install Google App Engine. 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 and run a scheduling algorithm that is not present in CloudSim.
7. Find a procedure to transfer the files from one virtual machine to another virtual machine.
8. Find a procedure to launch virtual machine using trystack (Openstack)
9. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
10. Create a Mashup using Yahoo! Pipes.

TEXT BOOKS:
1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.

REFERENCES:
1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing‖, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach‖, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)‖, O'Reilly, 2009.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VIII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS802	PROJECT WORK PHASE - II	0	0	18	6	-	100	

Course Objective (s):

The purpose of learning this course is to

- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Course Outcomes:

At the end of this course, learners will be able to:

- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
- Prepare report and present the oral demonstrations.

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| 2. | M. J. Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003. |
| 3 | B. Chapman, G. Jost, and Ruud van der Pas, "Using OpenMP", MIT Press, 2008 |

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester VIII	PC

Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CS801	HIGH PERFORMANCE COMPUTING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to
- Learn the different ways of exploiting Instruction Level Parallelism
- Study the various SIMD architectures.
- Understand the different multiprocessor architectures and warehouse scale computers.
- Understand message passing paradigm using MPI
- Learn shared memory programming paradigm with Pthreads and OpenMP

Course Outcomes: At the end of this course, learners will be able to:
- Explore Instruction Level Parallelism in a code
- Analyze the architecture of Vector, SIMD and GPU architecture.
- Compare symmetric and distributed memory multiprocessor systems.
- Analyze the issues in warehouse scale computing.
- Write parallel programs using MPI framework, Pthreads and OpenMP

Unit I	INSTRUCTION LEVEL PARALLELISM	9

Classes of computers - Dependability - Quantitative principles of computer design - Classes of parallelism- ILP: Concepts and challenges - Basic compiler techniques for exposing ILP - Branch prediction - Dynamic scheduling Hardware based Speculation - Multiple issue, static and dynamic scheduling - Limitations of ILP-- Case Study: Intel Core i7, ARM Cortex-A53.

Unit II	VECTOR, SIMD AND GPU ARCHITECTURES	9

Vector architecture: Vector Execution Time-Multiple Lanes-Vector-Length Registers-Vector Mask Registers-Vector Mask Register-Memory Banks-Stride-Gather-Scatter-Programming Vector Architecture. SIMD instruction set extensions for multimedia. Graphics processing units: Programming the GPU-NVIDIA GPU Computational Structures NVIDA GPU Instruction Set Architecture-NVIDIA GPU Memory Structures-Similarities and Differences between Vector Architectures and GPUs -Similarities and Differences between Multimedia SIMD Computers and GPUs. Detecting and Enhancing Loop Level Parallelism.

Unit III	MULTIPROCESSOR AND WAREHOUSE-SCALE ARCHITECTURE	9

Multiprocessor architecture: Issues and approaches - Centralized shared memory architecture – Multiprocessor cache coherence - Snooping cache coherence protocol-Basic Implementation Techniques - An example Protocol - Directory based cache coherence protocols. Warehouse - Scale Architectures: Programming models and workloads for Warehouse-Scale computers - Architecture for Warehouse-Scale computers - Physical infrastructure and costs - Cloud computing - Case studies.

Unit IV	MESSAGE PASSING PARADIGM	9

Basic MPI programming - MPI_Init and MPI_Finalize - MPI communicators - SPMD programs - Message passing - MPI_Send and MPI_Recv - Message matching - MPI I/O - Collective communication: MPI_Reduce - MPI_Allreduce - Broadcast – Scatter - Gather - Allgather - Derived Datatypes– Performance evaluation of MPI programs.

Unit V	PTHREADS AND OPENMP	14

Basics of Pthreads - Critical section - Busy waiting - Mutexes - Semaphores - Barriers and Condition variables. OpenMP: Basic OpenMP constructs - Scope of variables - Reduction clause - Parallel For directive - Scheduling loops - Synchronization in OpenMP: Locks, Atomic and Critical Directive.

TEXT BOOK(S):

1.	John L. Hennessey and David A. Patterson, "Computer architecture - A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 6th edition, 2017
2	Peter S. Pacheco, "An introduction to parallel programming", Morgan Kaufmann, 2011

REFERENCES

1.	Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill Education, 2003

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		L	T	P	C		
19CS705	PROJECT WORK- PHASE - I	0	0	2	1	30	100

Course Objective (s):

The purpose of learning this course is to
- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.

Course Outcomes:

At the end of this course, learners will be able to:
- Formulate a real world problem, identify the requirement and develop the design solutions.
- Express the technical ideas, strategies and methodologies

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	IV

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE01	C# AND .NET PROGRAMMING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- Understand the foundations of CLR execution.
- Learn the technologies of the .NET framework.
- Know the object oriented aspects of C#.
- Be aware of application development in .NET.
- Learn web based applications on .NET (ASP.NET).

Course Outcomes:

At the end of this course, learners will be able to:

- List the major elements of the .NET frame work and explain how C# fits into the .NET platform.
- Understand Object based concept of C#
- Debug, compile, and run a simple application.
- Analyze the basic structure of a C# application and web based development of C#
- Discuss CLR and security in .NET.

Unit I	INTRODUCTION TO C#	9

Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing

Unit II	OBJECT ORIENTED ASPECTS OF C#	9

Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading

Unit III	APPLICATION DEVELOPMENT ON .NET	9

Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration

Unit IV	WEB BASED APPLICATION DEVELOPMENT ON .NET	9

Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

Unit V	CLR AND .NET FRAMEWORK	9

Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

REFERENCE(S)	

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1.	Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill, 2012.
2.	Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012
3.	Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
4.	Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	V
Course Code	Course Name	\multicolumn{3}{c}{Hours / Week}	Credit	Total Hours	\multicolumn{2}{c}{Maximum Marks}
		L	T	P	C			
19CSPE02	ADVANCED JAVA PROGRAMMING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the basic concepts of core principles of the Java Language
- To gain knowledge to develop standalone applications.3
- To discuss basic principles of HTML, Java Script and XML
- To gain knowledge to develop dynamic Web applications like servlet,jsp.5
- To introduce tools, technologies and framework hence Hibernate and Spring are introduced to enhance web development skills.

Course Outcomes:

At the end of this course, learners will be able to:

- Ability to develop the application based on the java concepts
- Ability to solve the real world problems using concepts like swings, JDBC
- Analyze and design web-based information systems to meet certain business needs using HTML5, CSS, JavaScript
- Able to Design and develop interactive, client-side, server-side executable web applications using eclipse.
- Explore the features of various platforms and frameworks like hibernate, Spring ,struts used in web applications development

Unit I	JAVA FUNDAMENTALS	9

Overview of Java - Java modifiers-Wrapper classes-Argument passing in class & object Returning a value- Objects as arguments-Returning objects- Passing an array-constructors – this keyword- Inheritance- Use of super in calling parent class constructor-java.lang.Object and its methods – Passing arguments in super(): super(int), super(String) - super(String,String)-Packages-User defined exception-Collections-Swings-Event Handling-JDBC-JDBC Drivers-JDBC configuration(connection) - Statement – Callable Statement-prepared statements- Scrollable and updatable result sets - Query execution

Unit II	HTML, CSS AND JAVA SCRIPT	9

HTML common tags – List – Tables – Images – Forms – Frames -HTML5- Form design-CSS-Introduction to Java Scripts-storing data (data types) - Objects- Properties-Events-Decision making-Looping Functions-Array-Conversions-Processing HTML forms and validation using JavaScript-XMLDTD, XSD-XSLT-Well-formed XML, valid XML-Creating XML using XSD- DOM and SAX

Unit III	SERVLET	9

Overview of servlet-Servlet configuration-Servlet Architecture- Servlet life cycle-Servlet Request and Response- Generic Servlet ,Http Servlet- web.xml and its need - Servlet configuration- Session Tracking-servlet

Unit IV	JAVA SERVER PAGES	9

Introduction to JSP – Problem with servlet -Life cycle of JSP- scripting Elements (Expression

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tag, scriptlets tag and declarations tag)-JSP Directive Elements-page directive - JSP objects- Action Elements – Sharing data Between JSP pages Application Development using eclipse

| Unit V | JAVA FRAMEWORKS | 9 |

Hibernate Introduction-features-Architecture-Mapping and Configuration Files in Hibernate - Hibernate O/R Mappings –Hibernate query language-Simple examples using hibernate-Spring Introduction- Architecture-IOC container- Dependency Injection Bean – Getting started with Spring MVC framework- Simple examples using Spring-STRUTS – Introduction, Struts framework core components – Installing and setting up struts – Getting started with struts.

TEXT BOOK(S)
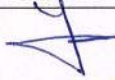
1.	Herbert Schildt, "Java The Complete Reference", 8th Edition, McGraw-Hill Osborne Media, 2015
2.	Paul Deitel, "Internet & World Wide Web: How to Program", Prentice Hall, 5th Edition, 2011.
3.	Gavin King, Christian Bauer, "Java Persistence with Hibernate", Dreamtech press, Kogent Learning Solutions Inc. 2008
4.	Craig Walls, "Spring in Action", Manning, Dreamtech press, 2014

REFERENCE(S)

1.	Cay S. Horstmann and Gary Cornell, "Core Java™, Volume I – Fundamentals" 9th Edition, Prentice Hall, 2012
2.	Robert W. Sebesta, "Programming the World Wide Web", Addison-Wesley, 7thEdition, 2012.
3.	UttamK.Roy, "Web Technologies", Oxford University Press, 1st Edition, 2011

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	V

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE03	OPEN SOURCE SYSTEMS	3	0	0	3	45	100

Course Objective (s):

- Impart knowledge on Opensource system and its benefits in application development
- learn different open source system such as Language, Database and operation system
- Develop web based applications using open source system

Course Outcomes:

At the end of this course, learners will be able to:

- Understand Open Source Software tools and techniques to develop applications
- Analyze the advantages and disadvantages of Open Source tools and languages with respect to proprietary Software
- Apply the Open Source Software in developing web based Applications and Internet of Things

Unit I	INTRODUCTION TO OPEN SOURCE OPERATING SYSTEMS	9

Introduction to Open Sources - Need of Open Sources -Advantages of Open Sources Application of Open Sources - Sources LINUX Introduction General Overview Kernel Mode and User Mode Process - Advanced Concepts -Scheduling - Personalities - Cloning - Signals -Development with Linux.

Unit II	OPEN SOURCES DATABASE	9

MySQL: Introduction - Setting up account - Starting, Terminating and Writing your Own SQL programs- Record Selection Technology - Working with Strings - Date and Time - sorting Query Results - Generating Summary - Working with metadata - Using Sequences - MySQL and Web.

Unit III	CONFIGURING SERVERS	9

Setting up email servers-- using postfix (SMTP services), courier (IMAP & POP3 services), squirrel mail (web mail services) Setting up file services -- using samba (file and authentication services for windows networks), using NFS (file services for gnu/Linux /Unix networks) ; Setting up proxy services -- using squid (http / ftp / https proxy services) ; Setting up printer services -using CUPS (print spooler), foomatic (printer database).

Unit IV	FIREWALL, BUILD SYSTEM, CVS	9

Setting up a firewall - Using netfilter and ip tables; Using the GNU Compiler Collection – GNU compiler tools ; the C preprocessor (cpp), the C compiler (gcc) and the C++ compiler (g++), assembler (gas) ; Understanding build systems -- constructing make files and using make, using autoconf and autogen to automatically generate make files tailored for different development environments ; Using source code versioning and management tools -- using CVS to manage source code revisions, patch & diff.

Unit V	SERVER TECHNOLOGIES	9

Web Server: Apache Server - Working with Web Server - Configuring and Using Apache Web Services - MDA - Introduction to MDA - Geneses of MDA - MDA Applications
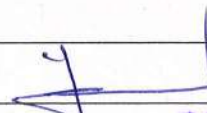
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TEXT BOOK(S)

1.	N. B. Venkateshwarlu (Ed); Introduction to Linux: Installation and Programming,B S Publishers; 2005
2.	Peter Wainwright, Professional Apache. Wrox Press, New Delhi, 2010
3.	M. N. RAO,Fundamentals of Open Source Software,PHI Learning Private Limited,2015

REFERENCE(S)

1.	H.S. Lahman Model-Based Development: Applications 1st edition Pearson Education Inc,2011
2.	Stephen J. Mellor, Marc Balces, "Executable UMS: A foundation for MDA", Addison,2002.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	V

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE04	R PROGRAMMING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing
- To understand the use of R Big Data analytics
- To able to appreciate and apply the R programming from a statistical perspective

Course Outcomes:

At the end of this course, learners will be able to:

- Create artful graphs to visualize complex data sets and functions
- Write more efficient code using parallel R and vectorization
- Interface R with C/C++ and Python for increased speed or functionality
- Find new packages for text analysis, image manipulation
- Perform statistical analysis of the same

Unit I	INTRODUCING TO R	9

R Data Structures – Help functions in R – Vectors – Scalars – Declarations –recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

Unit II	MATRICES, ARRAYS AND LISTS	12

Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists

Unit III	DATA FRAMES	15

Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

Unit IV	INTERFACING	9

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering

TEXT BOOK(S)

1.	Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011
2.	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

REFERENCE(S)

1.	Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2.	Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester		V

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE05	XML AND WEB SERVICES	3	0	0	3	45	100	

Course Objective (s):
- Learn the XML Technologies and modeling databases in XML
- Provide an overview of Service Oriented Architecture and the importance of Web services

Course Outcomes:

At the end of this course, learners will be able to:

- Impart knowledge in XML technologies to build robust XML applications
- Familiarize with concepts of SOA ,standards and technologies for building the Web Services
- Understand web services architectures
- Design web services using WSDL and SOAP
- Use the approaches for providing security for XML documents and the messages exchanged among Web Services

Unit I	XML TECHNOLOGY	9

Role of XML - XML and The Web - XML Language Basics - XML benefits - Advantages of XML over HTML - EDI - Databases - XML standards - DTD - XML Schemas - XML processing – DOM - SAX - presentation technologies - XSL - XFORMS - XHTML - Transformation - XSLT – XLINK - XPATH.

Unit II	SOA BASICS	9

Service Oriented Architecture (SOA) - Comparing SOA with Client-Server and Distributed architectures - Characteristics of SOA - Benefits of SOA - Principles of Service orientation – Service layers - Business Process management.

Unit III	ARCHITECTING WEB SERVICES	9

Business motivations for web services - B2B - B2C - limitations of CORBA and DCOM - Architecting web services - Implementation view - web services technology stack - logical view - composition of web services - deployment view - process view.

Unit IV	WEB SERVICES BUILDING BLOCKS	9

Transport protocols for web services - messaging with web services protocols - SOAP – describing web services: WSDL - Anatomy - manipulation - web service policy - Discovering web services: UDDI - Anatomy - Web service inspection - Web Services and E-business (E-com & ebXML).

Unit V	XML AND WEB SERVICES SECURITY	9

XML Security Overview - Canonicalization - XML Security Framework - XML Encryption – XML Signature - XKMS Structure - Web Services Security - XACML.

TEXT BOOK(S)	
1.	Ron Schmelzer, XML and Web Services, Pearson Education, 2008.
2.	Frank P Coyle, XML, Web Services and the Data Revolution, Pearson Education,

	2002.
REFERENCE(S)	
1.	Thomas Erl, Service Oriented Architecture: Concepts, Technology and Design, Pearson Education, 2005.
2.	Sandeep Chatterjee and James Webber, Developing Enterprise Web Services: An Architects Guide, Prentice Hall, 2004.
3.	Mark O Neill, Web Services Security, Tata McGraw-Hill, 2005.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	V

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE06	GRAPH THEORY AND ITS APPLICATIONS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to
- To understand the basics of graph data structure
- To familiarize Tree and its properties
- To understand the Representation of graph
- To know the various Graph Problems
- To Learn Directed graph and its applications

Course Outcomes:

At the end of this course, learners will be able to:
- Understand graph fundamentals
- Apply tree principles to solve problems
- Able to represent Graph
- Apply Graph to solve problems
- Analyze the properties of Directed Graph

Unit I	INTRODUCTION	9

Definitions, importance, isomorphism, walk, paths, circuits, connected, disconnected graphs, operation on graphs operation on graphs, Euler and Hamiltonian graphs

Unit II	TREES	9

Properties, distance and centers, trees, spanning trees, fundamental circuits, minimal spanning tree , Cut sets Properties, fundamental circuits and cut sets, connectivity, separatability, network flows, 1-2 isomorphism ,Planar and dual graphs, Combinatorial representation, planar graphs, kuratowski's graphs, detection of planarity, dual graphs

Unit III	MATRIX REPRESENTATION OF GRAPHS	9

Incidence matrix, circuit matrix, cut set matrix, fundamental matrices, relatonships amongst matrices, path matrix, and adjacency matrix

Unit IV	COLORING, COVERING AND PARTITIONING	9

Chromatic number, chromatic partitioning, matching, covering, four color problem

Unit V	DIRECTED GRAPHS	9

Different types, directed paths and connectedness, Euler digraphs, trees-matrix representation, tournament. Graph theoretic algorithms , Computer representation of graphs – input & output, algorithms for connectedness, spanning tree, fundamental circuits, cut vertices, directed circuits and shortest paths

TEXT BOOK(S)

1.	Narasing Deo, Graph Theory with Application To Engineering And Computer Science, Prentice Hall India, 2010
2.	Tulasiraman and M.N.S. Swamy, Graph, Networks and Algorithms, John Wiley, 1981

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	REFERENCE(S)
3.	F.Harary, Graph Theory, Addison Wesley/ Narosa, 1998
4.	E.M.Reingold, J.Nievergelt, N.Deo, Combinatorial Algorithms: Theory and Practice, Prentice Hall, N.J.1977

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	V
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE07	COMPUTER VISION	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- To build an understanding on detailed models of image formation.
- To expose the students to image feature recognition.
- To introduce fundamental algorithms for Filters
- To introduce various views
- To expose the students to various segmentation techniques

Course Outcomes:

At the end of this course, learners will be able to:

- Appreciate the detailed models of image formation.
- Analyse the techniques for image feature recognition.
- Apply various algorithms for Linear Filters
- Examine various of image
- Analyze segmentation algorithms and clustering of images

Unit I	IMAGE FORMATION AND IMAGE MODEL	9

Cameras: Pinhole Cameras-Cameras with Lenses, Human Eye, Geometric Camera Models: Elements of Analytical Euclidean Geometry-Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account

Unit II	RADIOMETRY MEASURING LIGHT	9

Light in space, Light at Surfaces ,Important Special Cases, Sources, Shadows and Shading:
Qualitative Radiometry Sources and their effects, Local Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color

Unit III	LINEAR FILTERS	9

Linear Filters and Convolution, Shift Invariant Linear System, Spatial Frequency and Fourier Transforms,Sampling and Aliasing, Filters as Templates, Technique Normalizes Co-relation and Finding Pattern, Edge Detection:Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis Using Oriented Pyramids,Application: Synthesizing Textures for Rendering, Shape From Texture

Unit IV	THE GEOMETRY OF MULTIPLE VIEWS	9

Two Views, Three Views, More Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, sing More Camera, Affine Structure from Motion: Elements of Affine Geometry, Affine Structure and Motion from Two Images, Affine Structure and Motion from Multiple Images, From Affine to Euclidean Images, Affine Motion Segmentation, Projective Structure from Motion: Elements of Projective Geometry, Projective Structure and Motion from Binocular Correspondences, Projective Motion Estimation from Multi-linear Constraints.

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Unit V	SEGMENTATION BY CLUSTERING	9

Human Vision Grouping and Gestalt, Applications: short Boundary detection and Background subtraction, Image Segmentation by Clustering Pixels, Segmentation By Graph-Theoretic Clustering, Segmentation By Fitting a Model: The Hough Transform, Fitting Lines, fitting Curves, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting and Segmentation, Tracking with linear dynamic models, Interference problem, kalman Filtering, Data Association, Application-Vehicle Tracking

TEXT BOOK(S)

1.	David A.Forsyth, Jean Ponce, "Computer Vision A Modern Approach", Prentice Hall, 2003
2.	Linda G. Shapiro, George C. Stockman , "Computer Vision", Published by Prentice Hall,2001.

REFERENCE(S)

3.	Dana H. Ballard, Christopher M. Brown, "Computer Vision", 2003. Prentice Hall

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE08	HUMAN COMPUTER INTERFACE	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- To learn the foundations of Human Computer Interaction.
- To understand the GUI concepts
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of screening in HCI.
- To learn the software tools used in user interface.

Course Outcomes:

At the end of this course, learners will be able to:

- Understand fundamentals of HCI
- Design effective HCI for graphical user interface.
- Design effective dialog for HCI.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface using software tools

Unit I	INTRODUCTION	9

Introduction : Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design

Unit II	GUI	9

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface

Unit III	HCI DESIGN	9

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions

Unit IV	CORE METHOLOGIES OF HCI	9

Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design

Unit V	SOFTWARE TOOLS AND OTHER DEVICES	9

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors. Software tools – Specification methods, interface – Building Tools. Interaction Devices – Keyboard and function keys – pointing devices – speech

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	recognition digitization and generation – image and video displays – drivers

TEXT BOOK(S)

1.	The essential guide to user "Interface design", Wilbert O Galitz, Wiley Dreama Tech
2.	Designing the user interface, 3rd Edition Ben Shneidermann, Pearson Education Asia
3.	Human – Computer Interaction, Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson, Prentice Hall (2004).

REFERENCE(S)

4.	Interaction Design Prec, Rogers, Sharps. Wiley Dreamtech
5.	User Interface Design, Soren Lauesen, Pearson Education

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE09	COMPUTER GRAPHICS AND MULTIMEDIA SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- To understand the basic output primitives
- To understand the three dimensional concepts
- To know basics of Multimeida system
- To understand the design of multimedia systems

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basic output primitives
- Apply three dimensional concepts
- Design multimedia system
- Understand the various multimedia I/O technologies
- Understand the Applications of Multimedia System

Unit I	OUTPUT PRIMITIVES	9

Introduction - Line - Curve And Ellipse Drawing Algorithms – Attributes – Two-Dimensional Geometric Transformations – Two-Dimensional Clipping And Viewing

Unit II	THREE-DIMENSIONAL CONCEPTS	9

Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three- Dimensional Viewing – Color Models – Animation.

Unit III	MULTIMEDIA SYSTEMS DESIGN	9

An Introduction – Multimedia Elements – Multimedia Applications – Multimedia Systems Architecture – Evolving Technologies for Multimedia – Defining Objects for Multimedia Systems – Multimedia Data Interface Standards – Need For Data Compression - Multimedia Databases. Compression and Decompression: Types of Compression – Binary Image Compression Schemes – Color, Gray Scale and Still – Video Image Compression - Audio Compression – Fractal Compression

Unit IV	MULTIMEDIA INPUT/OUTPUT TECHNOLOGIES	9
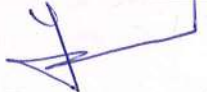
Key Technology Issues – Pen Input – Video and Image Display Systems – Print Output Technologies – Image Scanners - Digital Voice and Audio – Digital Camera - Video Images And Animation – Full-Motion Video. Storage and Retrieval Technologies: Magnetic Media Technology – Optical Media – Hierarchical Storage Management – Cache Management for Storage Systems

Unit V	MULTIMEDIA APPLICATION DESIGN	9

Multimedia Application Classes – Types Of Multimedia Systems – Virtual Reality Design – Components Of Multimedia Systems – Organizing Multimedia Databases – Application Workflow Design Issues – Distributed Application Design Issues.
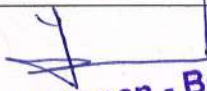
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TEXT BOOK(S)	
1.	Donald Hearn and M.Pauline Baker, "Computer Graphics C Version", Pearson Education, 2003.
2.	Prabhat K Andleigh and Kiran Thakrar," Multimedia Systems and Design", PHI, 2003. ISBN: 81-203-2177-4
REFERENCE(S)	
3.	Ze-Nain Li, Mark S.Drew, " Fundamentals of Multimedia", PHI. ISBN :81-203-2817-5.
4.	John F. Koegel Buford, " Multimedia Systems", Third Edition, 2000. ISBN: 8177588273

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE10	DIGITAL IMAGE PROCESSING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Fundamentals of digital image processing and transformation techniques.
- Performing image enhancement and image restoration
- To understand the image compression procedures, image segmentation and representation techniques.
- To learn image representation techniques
- To know about how to interpret the extracted data from the image

Course Outcomes:

At the end of this course, learners will be able to:

- Analyze and apply image transforms like Walsh, Hotelling transforms for images.
- Enhance the quality of images by image smoothening and image sharpening
- Apply Huffman coding, Shift codes, arithmetic coding and perform edge detection and segmentation for digital images
- Represent image using chain codes, linear signature, shape number,

Able to interpret the data and relate with real time cases

Unit I	DIGITAL IMAGE FUNDAMENTALS	9

Image formation - Image transforms - Fourier transforms - Walsh - Hadamard - Discrete cosine - Hotelling transforms

Unit II	IMAGE ENHANCEMENT & RESTORATION	9

Histogram modification techniques - Image smoothening - Image Sharpening - Image Restoration - Degradation Model – Noise models - Spatial filtering - Frequency domain filtering

Unit III	IMAGE COMPRESSION & SEGMENTATION	9

Runlength, Huffman coding, Shift codes, arithmetic coding, bit plane coding, transform coding, JPEG Standard, wavelet transform, predictive techniques, Block truncation coding schemes, Facet modeling- Image segmentation -Detection of discontinuities - Edge linking and boundary detection - Thresholding - Region based segmentation - Morphology.

Unit IV	REPRESENTATION AND DESCRIPTION	9

Boundary Representation using chain codes, Linear Signature, Shape number, Fourier descriptors, Moments Region representation, Regional descriptor, Texture, Relational Descriptors

Unit V	OBJECT RECOGNITION AND INTERPRETATION	9

Patterns and pattern classes - Decision -Theoretic methods - Structural methods. Case Studies : Image Processing in Medical field - Image processing in remote sensing satellites

TEXT BOOK(S)

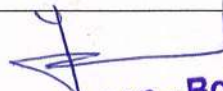| 1.	Gonzalez.R.C & Woods. R.E., ―Digital Image Processing‖, 2nd Edition, Pearson Education, 2002

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| 2. | Sid Ahmed, Image Processing, McGraw Hill, New York, 1995. |

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2.	http://www.olympusmicro.com/primer/resources/imageprocessing.html
3.	http://graphics.cs.cmu.edu/courses/15-463/2004_fall/www/463.html

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE11	DISTRIBUTED SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the basics of networking and the protocols used in distributed environment.
- To evaluate the impact of memory on parallel/distributed algorithm formulations and validate their performance.
- To gain knowledge of how to design and implement distributed algorithms

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basics of networking and protocols
- Analyze various issues in the design and implementation of distributed computing systems
- Categorize the various system models, communication between client and Server
- Apply the knowledge of deadlock methods and its algorithms
- Understand the significance of distributed file system with real time applications

Unit I	INTRODUCTION	7

Distributed Computing Models, Software Concepts, Hardware Concepts, The ClientServer model, Issues in design of a distributed operating system.

Unit II	COMMUNICATION	9

Introduction to Message Passing, Advantages and features of message passing, Message format, Message Buffering, Remote Procedure Call, Extended RPC Models, Remote Object Invocation, Message Oriented Communication.

Unit III	PROCESSES, SYNCHRONIZATION AND DISTRIBUTED DEADLOCK	11

Threads, code migration, clock synchronization, logical clocks, global state, Election algorithms, mutual exclusion, Distributed transaction. Distributed Deadlock Detection System model, Resources vs. communication deadlocks, deadlock prevention, avoidance, detection and resolution, Centralized deadlock detection, distributed deadlock detection, path pushing and edge chasing algorithm

Unit IV	DISTRIBUTED SHARED MEMORY	9

Distributed Shared Memory Introduction, General architecture of distributed shared memory, Design and implementation, Issues of DSM, Granularity, structure of shared memory space, consistency models, thrashing, advantages of DSM

Unit V	DISTRIBUTED FILE SYSTEM	9

Distributed File System Introduction, Desirable features of good distributed file system, file models, file accessing, sharing, caching methods, file replication, fault tolerance, Case Study: CORBA(CORBA RMI and Services)

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TEXT BOOK(S)	
1.	Andrew Tanenbaum, Maarten Van Steen, "Distributed System- Principals Paradigm", Maarten van Steen Publication,2016
2.	Singhal and Shivratri, "Advanced Concept in Operating Systems", McGraw Hill,2015
REFERENCE(S)	
1.	Sunita Mahajan, Seema Shah, " Distributed Computing", Oxford, 2nd edition,2013
2.	Pradeep K. Sinha "Distributed Operating Systems", Prentice Hall of India Private,2012
3.	George Coulouris, Tim Kindberg, Jean Dollimore, Distributed Systems: Concepts and Design, Academic Internet Publishers, 2006

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VI

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE12	INFORMATION RETRIEVAL TECHNIQUES	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
- To understand the concepts of digital libraries

Course Outcomes:

At the end of this course, learners will be able to:

- Build an Information Retrieval system using the available tools.
- Identify and design the various components of an Information Retrieval system.
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
- Design an efficient search engine and analyze the Web content structure

Unit I	INTRODUCTION: MOTIVATION	9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine

Unit II	MODELING	9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

Unit III	INDEXING	9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

Unit IV	CLASSIFICATION AND CLUSTERING	9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning

Unit V	SEARCHING THE WEB	9

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR:

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	Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries
REFERENCE(S)	
1.	Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, ―Introduction to Information Retrieval‖, Cambridge University Press, First South Asian Edition, 2008
2.	Implementing and Evaluating Search Engi1nes‖, The MIT Press, Cambridge, Massachusetts London, England, 2010
3.	Ricardo Baeza – Yates, Berthier Ribeiro – Neto, ―Modern Information Retrieval: The concepts and Technology behind Search‖ (ACM Press Books), Second Edition, 2011
4.	Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, ―Information Retrieval

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE13	SOCIAL NETWORK ANALYSIS	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- To understand the components of the social network.
- To model and visualize the social network
- To mine the users in the social network
- To understand the evolution of the social network.
- To mine the interest of the user

Course Outcomes:

At the end of this course, learners will be able to:

- Work on the internals components of the social network Model and visualize the social network
- Mine the behavior of the users in the social network Predict the possible next outcome of the social network Mine the opinion of the user

Unit I	INTRODUCTION	9

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks

Unit II	MODELING AND VISUALIZATION	9

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce – Ontological representation of social individuals and relationships.

Unit III	MINING COMMUNITIES	9

Aggregating and reasoning with social network data, Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks

Unit IV	EVOLUTION	9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models

Unit V	TEXT AND OPINION MINING	9

Text Mining in Social Networks -Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product

review mining – Review Classification – Tracking sentiments towards topics over time

	REFERENCE(S)
1.	Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2011
2.	Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition, 2007
3.	Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010
4.	Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2011
5.	Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010
6.	Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2009.

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE14	DATA WAREHOUSING AND DATA MINING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- To understand basics of data warehouse
- To learn data mining and association mining
- To understand classification and prediction
- To know cluster analysis technique
- To familiarize graph and multimedia mining

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basics of data warehouse
- Apply association rule mining
- Apply classification and prediction techniques
- Analyze data using cluster techniques
- Apply graph and multimedia mining

Unit I	INTRODUCTION TO DATA WAREHOUSE	9

Introduction- a multi dimensional data model – Data cube technology-Data warehouse architecture- Types of OLAP servers-Data warehouse implementation-Data warehousing to data mining

Unit II	INTRODUCTION TO DATA MINING AND ASSOCIATION MINING	9

Data mining – functionalities - Major issues - Data cleaning - Data integration and Transformation - Data reduction - Discretization and concept hierarchy generation-Efficient and scalable frequent item set mining methods-Mining various kinds of association rules-Association mining to correlation analysis-Constraint based association mining

Unit III	CLASSIFICATION AND PREDICTION	9

Introduction – Issues – Classification by decision tree induction - Bayesian classification- Rule based classification. Classification by back propagation- Other classification methods-Prediction-Accuracy and error measures- Evaluating the accuracy

Unit IV	CLUSTER ANALYSIS	9

Cluster analysis – Types of data – Partitioning methods – Hierarchical methods – Density based methods-Grid based methods – Model based Clustering methods – Clustering High dimensional data – Constraint based cluster analysis – outlier analysis-Data mining Applications-Data mining system products-Additional themes on data mining.

Unit V	GRAPH MINING AND MULTIMEDIA MINING	9

Graph mining- Multirelational data mining-Multidimensional analysis and descriptive mining of complex data objects. Spatial data mining-Multimedia data mining-Text mining-Mining the world wide web-Data mining applications

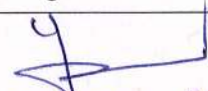| REFERENCE(S)	
1.	Jiewei Han, Micheline Kamber, "Data mining concepts and techniques", Morgan Kaufmann Pub, 2006

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2.	William H. Inmon, "Building the data ware house", Wiley Dreamtech (p) Ltd., IV Edition, 2005.
3.	Ian H.Witten, Eibe Frank, "Data Mining: Practical M/c Learning tools and techniques with Java implementation", Third Edition, Morgan Kaufman, 2000
4.	K.P.Soman,Shyam Diwakar,V.Ajay, " Insight into Data Mining, theory and practice", PHI Learning private Limited, 2010.
5.	Ronen Feldman, James Sangee, "The Text Mining Handbook: Advanced Approaches in analyzing unstructured data", Cambridge University Press, 2007

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE15	SOFTWARE PROJECT MANAGEMENT	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- To understand the Software Project Planning.
- To plan and Evaluation techniques.
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.

Course Outcomes:

At the end of this course, learners will be able to:

- Understand Project Management principle s while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the check points, project monitoring structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

Unit I	INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT	9

Project Definition – Contract Management – Activities Covered by Software - Project Management – Overview Of Project Planning – Stepwise Project Planning

Unit II	PROJECT EVALUATION	9

Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation. – software effort estimation

Unit III	ACTIVITY PLANNING	9

Objectives – Project Schedule – Sequencing and Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning and Control

Unit IV	MONITORING AND CONTROL	9

Resource allocation - identifying and scheduling resources – Publishing resource and cost schedule – Scheduling sequence - Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Priortizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance

Unit V	MANAGING PEOPLE AND ORGANIZING TEAMS	9

Introduction – Understanding Behavior – Organizational Behaviour - Selecting The Right Person

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For The Job – Instruction In The Best Methods – Motivation – The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team – Decision Making – Leadership – Organizational Structures – Stress – Health And Safety – Case Studies

REFERENCE(S)

1.	Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill, 2004.
2.	Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001
3.	Royce, "Software Project Management", Pearson Education, 1999.
4.	Jalote, "Software Project Management in Practice", Pearson Education, 2002.
5.	Robert T. Futrell, Donald F. Shefer and Linda I. Shefer, "Quality Software Project Management", Pearson Education, 2003
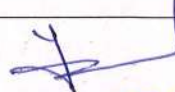
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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE16	CYBER SECURITY AND ETHICAL HACKING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Understand the fundamental concepts of cyber Security
- Learn various hacking techniques and attacks.
- Assess and measure threats to information assets.
- Understand the benefits of strategic planning process.
- Evaluate where information networks are most vulnerable.
- Enable students to understand issues in the Internet

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basics of Cyber Security
- Defend hacking attacks and protect data assets.
- Defend a computer against a variety of different types of security attacks using a number of hands on techniques.
- Defend a LAN against a variety of different types of security attacks using a number of hands on techniques.
- Practice and use safe techniques on the World Wide Web

Unit I	INTRODUCTION	9

Network and security concepts: Information assurance - Basic cryptography – DNS - Firewalls - Virtualization, Microsoft windows security principles, creating a managed network, defining the boundaries of trust, Implementing the network security function- attacker techniques physical security.

Unit II	SYSTEM HACKING	9

Hacking Windows: Overview - Unauthenticated attacks - Authenticated attacks - Windows security features – Spoofing – Case study. Hacking UNIX: Overview - Quest for root - Remote Access - Local Access - Types – Hacking root - Sniffers - Case study.

Unit III	INFRASTRUCTURE HACKING	9

Remote Connectivity & VOIP Hacking - Preparing to dial up - VPN Hacking - Network Devices - Discovery, Autonomous system lookup - Public News groups – Network Vulnerability. Wireless Hacking: Wireless Foot Printing - Wireless Scanning and Enumeration - Hacking 802.11 – WEP Hacking Hardware: Hacking Devices - Analysis default configurations-Reverse Engineering Hardware

Unit IV	APPLICATION AND DATA HIDING	9

Hacking Code - Common Exploit Techniques - Common Counter Measures.WEP Hacking: Web Server Hacking - Web Application Hacking - Vulnerabilities - Hacking the Internet user - Client Hacking - Malware - Spyware - Adware - Spam - Phishing - Case Study

Unit V	REMOTE CONTROL INSECURITIES	9

Discovering Remote Control Software – Session Hijacking - Backdoors - Trojans - Subverting the system Environment - Social Engineering – Weakness VNC - Case Study.

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TEXT BOOK (S)	
1.	McClure, Joel Scambray and Goerge Kurtz, "Hacking Exposed Network Security Secrets & Solutions" ,Tata Mcgrawhill Publishers,2010
2.	T Simpson "Ethical Hacking and Network Defense", cengage learning, 2010

REFEENCE(S)	
1.	Brian Komer," Microsoft Windows Security Resource Kit" Prentice Hall of India , 2010.
2.	Fadia ,"Unofficial guide to ethical hacking", Macmillan India Limited,2001
3.	Fadia, Manu zacharia "Intrusion alert : An Ethical Hacking Guide to Intrusion Detection",2009

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE17	WIRELESS SENSOR NETWORKS	3	0	0	3	45	100

Course Objective (s):
- To study about Wireless networks, protocol stack and standards.
- To study about fundamentals of 3G Services, its protocols and applications.
- To study about evolution of 4G Networks, its architecture and applications

Course Outcomes:

At the end of this course, learners will be able to:
- Categorize the latest 3G / 4G and WiMax networks and its architecture.
- Implement wireless network environment for any application using latest wireless protocols and standards.
- Implement different type of applications for smart phones and mobile devices with latest network strategies.
- Know the fundamentals of Wireless Wide Area Network
- Understand basics of 45 Networks

Unit I	**WIRELESS LAN**	9

Introduction, WLAN technologies: Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security , IEEE802.16,WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

Unit II	**MOBILE NETWORK LAYER**	9

Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6,Network layer in the internet, Mobile IP session initiation protocol , mobile ad,hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.

Unit III	**MOBILE TRANSPORT LAYER**	9

TCP enhancements for wireless protocols , Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility , Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP , TCP over 3G wireless networks.

Unit IV	**WIRELESS WIDE AREA NETWORK**	9

Overview of UTMS Terrestrial Radio access network, UMTS Core network Architecture: 3G,MSC, 3G,SGSN, 3G,GGSN, SMS,GMSC/SMS,IWMSC, Firewall, DNS/DHCP, High speed Downlink packet access (HSDPA), LTE network architecture and protocol

Unit V	**4G NETWORKS**	9

4G vision – 4G features and challenges , Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM,MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

TEXT BOOK(S)

1.	Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.

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2.	Vijay Garg , "Wireless Communications and networking", First Edition, Elsevier 2007.

REFERENCE(S)

1.	Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008
2.	Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition,Pearson Education, 2013

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VII

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE18	PROFESSIONAL ETHICS IN ENGINEERING	3	0	0	3	45	100	

Course Objective (s):

- The purpose of learning this course is to
- To understand the importance of engineering ethics in an organizational setting.
- To learn the various ethics and human values in workplace.
- To understand the features of moral reasoning, moral explanations and the role of moral theories.

Course Outcomes:

At the end of this course, learners will be able to:

- Analyze professional ethics and responsibilities.
- Practice professional responsibilities and rights.
- Solve moral dilemmas faced by professionals using ethical values
- Assess Safety and Risk
- Understand the Global Issues in Ethics

Unit I	HUMAN VALUES	9

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation –Commitment – Empathy – Self-Confidence – Character – Spirituality

Unit II	ENGINEERING ETHICS	9

Senses of _Engineering Ethics' - variety of moral issued - 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

Unit III	ENGINEERING AS SOCIAL EXPERIMENTATION	9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – a balanced outlook on law - the challenger case study
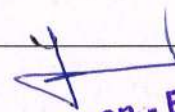
Unit IV	SAFETY, RESPONSIBILITIES AND RIGHTS	9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority – collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights – employee rights -Intellectual Property Rights (IPR) - discrimination

Unit V	GLOBAL ISSUES	9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors –moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India, etc

TEXT BOOK

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1.	Mike Martin and Roland Schinzinger, —Ethics in Engineering‖, McGraw-Hill, New York, 2005
2.	Govindarajan M, Natarajan S, Senthil Kumar V. S, —Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004
3.	Charles D. Fleddermann, —Engineering Ethics‖, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint).

REFERENCE(S)

1.	Charles E Harris, Michael S. Protchard and Michael J Rabins, —Engineering Ethics – Concepts and Cases‖, Wadsworth Thompson Learning, United States, 2000
2.	John R Boatright, —Ethics and the Conduct of Business‖, Pearson Education, New Delhi, 2003
3.	Edmund G Seebauer and Robert L Barry, —Fundamentals of Ethics for Scientists and Engineers‖, Oxford University Press, Oxford, 2001

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE19	SEMANTIC WEB	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to
- To understand the basics of Ontologies
- To learn the Ontologies languages
- To know the Ontology management tools
- To learn the applications of Ontology

Course Outcomes:

At the end of this course, learners will be able to:
- Understand the principles of Ontology
- Apply ontology tools for web analysis
- Apply various ontology algorithms
- Manage ontology using tools
- Understand the applications of ontology

Unit I	INTRODUCTION	9

Components – Types – Ontological Commitments – Ontological Categories –Philosophical Background - Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation – Layers – Architecture

Unit II	LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES	9

Web Documents in XML – RDF - Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF –Overview – Syntax Structure – Semantics – Pragmatics - Traditional Ontology Languages – LOOM- OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL - DAML + OIL- OWL

Unit III	ONTOLOGY LEARNING FOR SEMANTIC WEB	9

Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms - Evaluation

Unit IV	ONTOLOGY MANAGEMENT AND TOOLS	9

Overview – need for management – development process – target ontology – ontology mapping – skills management system – ontological class – constraints – issues. Evolution – Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools

Unit V	APPLICATIONS	9

Web Services – Semantic Web Services - Case Study for specific domain – Security issues – current trends

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	TEXT BOOKS
1.	Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez, "Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web" Springer, 2004
2.	Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004
	REFERENCE(S)
3.	James Hendler, Henry Lieberman and Wolfgang Wahlster, Spinning the Semantic Web: Bringing the world wide web to its full potential. New Delhi: The MIT Press, 2004.
4.	Shelley Powers, Practical RDF. Mumbai: O'reilly publishers, 2003

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE20	INFORMATION STORAGE MANAGEMENT	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand data creation, the amount of data being created, the value of data to a business, challenges in data storage and data management,
- To understand solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the concept of data storage architecture
- Know the evolution of Storage Technologies
- Analyze the Network Storage Architecture
- Use replication technologies in storage management
- Design Secure Storage Management

Unit I	INTRODUCTION	9

Data, Information, Evolution of storage architecture, Data center infrastructure, Information lifecycle. Overview: Virtualization - Cloud, Data center environment: Application - Desktop - Memory virtualization - Connectivity - Disk drive interface - Storage media - Flash drives, RAID: Implementation - Methods - Levels, Intelligent storage system

Unit II	EVOLUTION	9

Introduction to DAS and SCSI, SAN: Evolution - Components - Connectivity options - Ports - FC architecture - Zoning – FC topologies, SAN based virtualization: Block level - VSAN, IP SAN: iSCSI - FCIP components - FCIP topology and frame structure, FCOE: Components – Benefits

Unit III	NETWORK STORAGE	9

NAS: Benefits – Components - Implementations - File sharing protocols - I/O operations - Factors affecting NAS performance - File level virtualization, Object based storage: Operation Benefits - Fixed content and archives - Archive types, CAS: Architecture - Operations - Use cases, Unified storage

Unit IV	INFORMATION AVAILABILITY	9

Introduction: Information availability - BC terminology – Planning lifecycle - Business impact analysis - Technology solutions, Backup and restore: Purposes - Methods - Architecture - Operations - SCB - Topologies - Targets - Deduplication, Local Replication: Terminology - Data consistency - Technologies - Restore and restart considerations, Remote replication: Modes - Technologies - Advanced replication technologies.

Unit V	SECURING THE STORAGE INFRASTRUCTURE	9

Securing the storage infrastructure: Security terminology – Security framework – Risk triad - Security domains -Implementations - Managing the storage infrastructure: Monitoring - Activities - Challenges - Solutions Data Warehousing with Oracle BI

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TEXT BOOK(S)	
1.	Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, New Delhi, 2006.
2.	Somasundaram G, Alok Shrivastava, "ISM – Storing, Managing and Protecting Digital Information", EMC Education Services, Wiley India, New Delhi, 2012.
REFERENCE(S)	
1.	Gerald J Kowalski, Mark T Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", BS Publications, New Delhi, 2009.
2.	Marc Farley Osborne, "Building Storage Networks", Tata McGraw Hill, New Delhi, 2001
3.	Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education, New Delhi, 2002.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE21	SOFT COMPUTING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- To introduce the concepts of neural networks and advanced neural networks
- To understand the advanced concepts vector quantification and self organizing maps
- To understand the fundamentals of fuzzy sets and fuzzy logic
- To establish basic knowledge about optimization techniques in soft computing.

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basic Neural Network Architecture
- Apply Advanced Neural Network architecture to solve problems
- Use Fuzzy set and relations in problem solving
- Design Fuzzy logic based system
- Apply optimization techniques in computation

Unit I	NEURAL NETWORKS	9

History, Mathematical model of neuron, ANN architectures, Learning rules, Learning Paradigms. Perceptron network, Backpropagation network, Backpropagation learning and its applications, Variants of BPA

Unit II	ADVANCED NEURAL NETWORKS	9

Associative Memory: Auto correlation, Hetero Correlation, Exponential BAM, Applications. Adaptive Resonance Theory: Vector Quantization, ART1, ART2, applications, Kohonen's Self Organizing Map

Unit III	FUZZY SETS AND RELATIONS	9

Uncertainty and Imprecision, Chance vs ambiguity, Fuzzy Sets, Fuzzy Relations, Membership functions, Properties of Membership functions, Fuzzification and Defuzzification

Unit IV	FUZZY LOGIC	9

Classical Logic and Fuzzy logic, Fuzzy Rule based systems, Fuzzy Decision making, Fuzzy Classification, Fuzzy Pattern Recognition, Applications – MATLAB and Soft Computing

Unit V	OPTIMIZATION TECHNIQUES	9

Derivative based Optimization – Descent Methods – Genetic Algorithms – Ant Colony Optimization – Particle Swarm Optimization, Case Study - fraud detection, health care using Soft computing techniques

TEXT BOOKS

1.	T.J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3rd Edition, 2010
2.	S. Rajasekaran and G.A.V. Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", PHI, 2012

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REFERENCE(S)	
1.	Davis E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Pearson Educaton, 2009
2.	Zurada, J.M. "Introduction to Artificial Neural systems", Jaico Publishing House, 2012

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE22	NATURAL LANGUAGE PROCESSING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- The student should be made to:
- Learn the techniques in natural language processing.
- Be familiar with the natural language generation.
- Be exposed to machine translation.
- Understand the information retrieval techniques

Course Outcomes:

At the end of this course, learners will be able to:

- Analyze the natural language text.
- Generate the natural language.
- Perform Semantic Analysis
- Do machine translation.
- Apply information retrieval techniques

Unit I	OVERVIEW AND LANGUAGE MODELING	9

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages, NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model

Unit II	WORD LEVEL AND SYNTACTIC ANALYSIS	9

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.
Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing

Unit III	SEMANTIC ANALYSIS AND DISCOURSE PROCESSING	9

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure

Unit IV	NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION	9

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages

Unit V	INFORMATION RETRIEVAL AND LEXICAL RESOURCES	9

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame NetStemmers-POS Tagger- Research Corpora

REFERENCE(S)

1.	Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008
2.	Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition",

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	2nd Edition, Prentice Hall, 2008.
3.	James Allen, "Natural Language Understanding", 2nd edition, Benjamin /Cummings publishing company, 1995.

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE23	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- Bring a systematic knowledge of the management information technology.
- Analyze the concepts which are used in information systems to make the Graduates effective
- Analyze the knowledge on effective application of information systems in business

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the importance of information
- Understand organizational and decision making in business
- Analyze the role of the major types of information systems in a business environment and their relationship to each other
- Understand the various Decision Support Systems
- Assess the impact of the Internet technology on business-electronic commerce and electronic business

Unit I	INFORMATION SYSTEM AND ORGANIZATION	9

Matching the Information System Plan to the Organizational Strategic Plan-Identifying Key Organizational Objective and Processes and Developing an Information System Development Technology of Information Systems- Concepts-Definition - Role and impact of MIS - Role and importance of management-Approaches to Management - Functions of the manager – Management as a control system

Unit II	DECISION MAKING AND INFORMATION	9

Decision making concepts - Methods- Tools and Procedures - Behavioral concepts in Decision making - Organizational Decision Making - Information concepts as a quality Product - Classification of the information - Methods of Data and information Collection - Value of the information - Human as a information Processor - Organization and Information.

Unit III	SYSTEM ANALYSIS AND DESIGN	9

Systems Development Life Cycle-CASE Tools - Object Oriented Systems-System analysis and design-Need for system Analysis - System Analysis of existing System - New Requirement - System Development Model - Structured Systems Analysis and Design - Computer System Design - Development of MIS - Development of long Range plans of the MIS - Ascertaining the class of information

Unit IV	DECISION SUPPORT SYSTEMS	9

Decision Support Systems - Business Intelligence and Analytics - Group Decision Support Systems - Executive Information Systems - Executive Support Systems - Geographical Information Systems - Artificial Intelligence- Deterministic systems- Knowledge Based Expert System MIS and the role of DSS - Enterprise management systems - EMS - Enterprise Resource Planning (ERP) system - ERP basic features - Benefits - Selection - Implementation

Unit V	CURRENT TRENDS	9

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Knowledge management -Networks - Internet and Web based Information System – Electronic Commerce - Electronic Business - Commercial applications

TEXT BOOK(S)

1.	George M Marakas, James A O'Brien ,Management Information Systems (English, Mcgraw Hill Education,10th Edition 2013
2.	W S Jawadekar, Management Information Systems, Tata McGraw Hill Publishing Company Limited 2008

REFERENCE(S)

1.	Kenneth C Laudon, Jane P Laudon ,Mary E Brabston ,Management Information Systems - Managing the Digital Firm,Fourth Canadian Edition, Pearson Prentice Hall,2008
2.	Applegate, Lynda M et al,Corporate Information Strategy and Management: Text and Cases,McGraw-Hill, 2003

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE24	SPEECH PROCESSING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- To introduce speech production and related parameters of speech.
- To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.

Course Outcomes:

At the end of this course, learners will be able to:

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different speech synthesis techniques.

Unit I	BASIC CONCEPTS	9

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Unit II	SPEECH ANALYSIS	9

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths

Unit III	SPEECH MODELING	9

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

Unit IV	SPEECH RECOGNITION	9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status

Unit V	SPEECH SYNTHESIS	9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status

TEXT BOOK(S)

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1.	Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003
2.	Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.
3.	Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997

REFERENCE(S)

1.	Steven W. Smith, "The Scientist and Engineer"s Guide to Digital Signal Processing", California Technical Publishing, 1997
2.	Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004
3.	Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VIII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE25	PARALLEL ALGORITHMS	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- To provide fundamentals in design, analysis, and implementation, of high performance computational science and engineering applications.
- To gain knowledge on parallel algorithms and their impact in engineering problem

Course Outcomes:

At the end of this course, learners will be able to:

- Develop knowledge and skills concerning applications of high-performance computing systems
- Identify parallel computing requirements.
- Use parallel programming concepts in developing real-world applications
- Measure, identify performance bottlenecks

Unit I	INTRODUCTION	9

Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi-scale, multi-discipline applications)

Unit II	HIGH-END COMPUTER SYSTEMS	9

Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared - memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Pataskala Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose built

Unit III	PARALLEL ALGORITHMS	9

Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divid e and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques

Unit IV	PARALLEL PROGRAMMING	9

Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)

Unit V	ACHIEVING PERFORMANCE	9

Measuring performance, Identifying performance bottlenecks, restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, Using existing libraries, tools, and frameworks

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REFERENCE(S)	
1.	Ananth Grama, Anshul Gupta, George Karypis, and ,Vipin Kumar, Introduction to Parallel Computing, 2nd edition, Addison-Welsey,2003
2.	David A. Bader (Ed.), Petascale Computing: Algorithms and Applications, Chapman & Hall/CRC Computational Science Series, 2008

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VIII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE26	SOFTWARE QUALITY ASSURANCE	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to
- To study the various hierarchical model for software metric
- To learn different types of documentation in software quality assurance.
- To understand the various aspects in quality control and reliability.
- To study the different ISO 9000 series of quality management standards for software development.

Course Outcomes:

At the end of this course, learners will be able to:
- Design different types of quality measures and standards for web based application.
- Use six sigma concepts for software development
- Analyze Reliability growth models for software quality assessment
- Understand various Quality Standards

Unit I	INTRODUCTION TO SOFTWARE QUALITY	9

Software Quality – Hierarchical models of Boehm and McCall – Quality measurement – Metrics measurement and analysis – Gilb's approach – GQM Model

Unit II	SOFTWARE QUALITY ASSURANCE	9

Quality tasks – SQA plan – Teams – Characteristics – Implementation – Documentation – Reviews and Audits

Unit III	QUALITY CONTROL AND RELIABILITY	9

Tools for Quality – Ishikawa's basic tools – CASE tools – Defect prevention and removal – Reliability models – Rayleigh model – Reliability growth models for quality assessment

Unit IV	QUALITY MANAGEMENT SYSTEM	9

Elements of QMS – Rayleigh model framework – Reliability Growth models for QMS – Complexity metrics and models – Customer satisfaction analysis

Unit V	QUALITY STANDARDS	9

Need for standards – ISO 9000 Series – ISO 9000-3 for software development – CMM and CMMI – Six Sigma concepts. Role of Statistical Methods in Software Quality –Transforming Requirements into test cases – Trends in the Quality Assurance Area - Mobile Application Testing - Business Intelligence Testing

TEXT BOOKS

1.	Allan C. Gillies, —Software Quality: Theory and Managementǁ, Thomson Learning, 2003

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2.	Stephen H. Kan, —Metrics and Models in Software Quality Engineering‖, Pearson Education (Singapore) Pte Ltd., 2003.

REFERENCE(S)

1.	Norman E. Fenton and Shari Lawrence Pfleeger, —Software Metrics‖ Thomson, 2003
2.	Mordechai Ben – Menachem and Garry S.Marliss, —Software Quality‖, Thomson Asia Pte Ltd, 2003.
3.	Mary Beth Chrissis, Mike Konrad and Sandy Shrum, —CMMI‖, Pearson Education 2003.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VIII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE27	ROBOTICS	3	0	0	3	45	100	

Course Objective (s):
- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basic functions of Components of Robot
- Know use of Robot Drive Systems and Effectors
- Design Robot systems using Sensors and Machine Vision
- Write Robot Programming
- Know the applications of Robot in Industries

Unit I	**FUNDAMENTALS OF ROBOT**	9

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load Robot Parts and their Functions-Need for Robots-Different Applications

Unit II	**ROBOT DRIVE SYSTEMS AND END EFFECTORS**	9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

Unit III	**SENSORS AND MACHINE VISION**	9

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

Unit IV	**ROBOT KINEMATICS AND ROBOT PROGRAMMING**	9

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and

problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

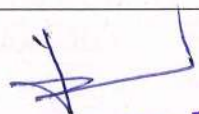| Unit V	IMPLEMENTATION AND ROBOT ECONOMICS	9

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TEXT BOOK(S)

1.	Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.
2.	Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.
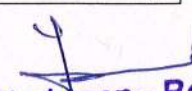
REFERENCE(S)

1.	Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008
2.	Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 1994.
3.	Koren Y., "Robotics for Engineers", Mc Graw Hill Book Co., 1992.

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE28	VIRTUAL AND AUGUMENTED REALITY	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To make students know the basic concept and framework of virtual reality.
- To teach students the principles and multidisciplinary features of virtual reality.
- To teach students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behavior.
- To teach students the technology for managing large scale VR environment in real time.
- To provide students with an introduction to the VR system framework and development tools.

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basics of Virtual Reality
- Understand the architecture of Computer Graphics
- Model Virtual Reality System
- Develop 3D virtual environments and to develop 3D interaction techniques.
- Develop immersive virtual reality applications.

Unit I	INTRODUCTION OF VIRTUAL REALITY	9

Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Multiple Modals of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.

Unit II	VISUAL COMPUTATION IN VIRTUAL REALITY	9

Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering

Unit III	MODELING	9

Geometric Modelling, Behaviour Simulation, Physically Based Simulation. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

Unit IV	INTRODUCTION TO AR	9

System Structure of Augmented Reality. Key Technology in AR. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools

Unit V	APPLICATION OF VR	9

VR Technology in Film & TV Production.VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR

TEXT BOOK(S)

1.	G. C., Coiffet P., "Virtual Reality Technology", J. Wiley & Sons, Second Ed., 2003. William R. Sherman and Alan Craig, "Understanding Virtual Reality: Interface,

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	Application, and Design" Morgan Kaufmann Publishers.
2.	Garey and Gavin Bell, "The Annotated VRML 2.0 Reference Manual", Addison-Wesley. John Vince, "Virtual Reality Systems", Pearson Education.

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VIII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE29	BIO INFORMATICS	3	0	0	3	45	100

Course Objective (s):
- Understand the purpose and categories of Bio informatics technologies.
- Understand the neural network concepts in Bioinformatics.
- Study about the Micro array Analysis.

Course Outcomes:
At the end of this course, learners will be able to:
- Understand the concepts of genomics, proteomics and Data mining in Bioinformatics
- Evaluate bioinformatics algorithms such as dynamic programming
- Apply hidden markov models and monte carlo
- Design various bioinformatics tools for pattern matching and visualization
- Apply Microarray Analysis for Gene classification and genome expression

Unit I	INTRODUCTION	9

Need for Bioinformatics technologies -Overview of Bioinformatics technologies -Structural bioinformatics- Data format and processing -secondary resources and applications - Role of Structural bioinformatics.

Unit II	DATA WAREHOUSING AND DATA MINING IN BIOINFORMATICS	9

Bioinformatics data - Data warehousing architecture - data quality - Biomedical data analysis – DNA data analysis - Protein data analysis - Neural Network Architecture -Neural Network Applications in Bioinformatics

Unit III	MODELING FOR BIOINFORMATICS	9

Hidden markov modeling for biological data analysis -Sequence identification - Sequence classification - multiple alignment generation - Comparative modeling - Protein modeling – genomic modeling - Probabilistic modeling - Bayesian networks - Boolean networks - Molecular modeling

Unit IV	PATTERN MATCHING AND VISUALIZATION	9

Gene regulation - motif recognition - motif detection - strategies for motif detection - Visualization - Fractal analysis - DNA walk models - one dimension - two dimension - higher dimension – Game representation of Biological sequences .

Unit V	MICROARRAY ANALYSIS	9

Microarray technology for genome expression study - image analysis for data extraction - preprocessing - segmentation - gridding - spot extraction - normalization, filtering - cluster analysis - gene network analysis - Compared Evaluation of Scientific Data Management Systems – Cost Matrix - Evaluation model - Benchmark.

TEXT BOOK(S)

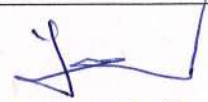| 1.	Arthur M.Lesk, Introduction to Bioinformatics,4th edition Oxford University Press, 2014.

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2.	Gautam B. Singh, Fundamentals of Bioinformatics and Computational Biology: methods and exercises in Matlab, Springer, 2014

REFERENCE(S)

1.	Yi-Ping Phoebe Chen, BioInformatics Technologies, Springer Verlag, 2010
2.	M. Abhilash, Introduction to Bioinformatics and Microarray Technology, CBS Publishers & Distributors, 2010

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Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE30	BLOCK CHAIN TECHNOLOGY	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Explain how bitcoin works, from when a transaction is created to when it is considered part of the block chain Thoroughly explain private and public keys as well as addresses and how exactly they are constructed and used
- Expose the students to the Bitcoin Script language including developing different type of scripts using the provided API.
- Explain to students both fundamental and implied differences between Ethereum and Bitcoin protocol by covering historical, conceptual and architectural distinctions
- Provide a detailed covering of the most prominent smart contract platform Ethereum and expose students to its main programming language Solidity

Course Outcomes: At the end of this course, learners will be able to

- Discover the secure and efficient transactions with crypto-currencies
- Experiment with crypto currency trading and crypto exchanges
- Understand the fundamentals of Bitcoin
- Develop private block chain environment and develop a smart contract on ethereum
- Build the hyper ledger architecture and the consensus mechanism applied in the hyper ledger

Unit I	CRYPTOCURRENCY AND BLOCKCHAIN-INTRODUCTION	9

Blockchain-An Introduction, Distinction between databases and blockchain, Distributed ledger. Blockchain ecosystem -Consensus Algorithms & Types, Blockchain 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, Creationof trustless Ecosystems –Block chain as a Service –Open Source Block chains

Unit II	CRYPTO CURRENCIES	9

Crypto Currencies -Anonymity and Pseudonymity in Cryptocurrencies -Digital Signatures - Cryptocurrency Hash Codes -Need for CryptoCurrencies –Crypto Markets –Explore Crypto Currency Ecosystems -ICOs –Crypto Tokens -Atomic Swaps –CryptoCurrency Exchanges – Centralised and Decentralized Crypto exchanges –Regulations on Crypto Currencies & exchanges –Downside of non-regulated currencies –crypto Scams –Exchange hacks

Unit III	BITCOIN	9

Bitcoin –history-Bitcoin-usage, storage, selling, transactions, working-Invalid Transactions-Parameters that invalidate the transactions-Scripting language in Bitcoin-Applications of Bitcoin script-Nodes and network of Bitcoin-Bitcoin ecosystem

Unit IV	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-different stages of a contract deployment-Viewing Information about blocks in Blockchain-Developing smart contract on private Blockchain-Deploying contract from web and console

Unit V	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

TEXT BOOK(S)

1.	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 20182.
2.	Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016

REFERENCE BOOK(S)

1.	Melanie Swan, Blockchain: Blueprint for a New Economy, First Edition 2018

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE31	DATA VISUALIZATON TECHNIQUES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is
- To develop skills to both design and critique visualizations.
- To introduce visual perception and core skills for visual analysis and for time-series analysis.
- To understand visualization for ranking and deviation analysis.
- To understand visualization for distribution analysis and multivariate analysis.
- To understand issues and best practices in information dashboard design

Course Outcomes: At the end of this course, learners will be able to
- Explain principles of visual perception
- Apply core skills for visual analysis
- Apply visualization techniques for various data analysis tasks
- Design information dashboard
- Use visualization Libraries in real time applications

Unit I	CORE SKILLS FOR VISUAL ANALYSIS	9

Information visualization – effective data analysis – traits of meaningful data – visual perception –making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

Unit II	TIME-SERIES, RANKING, AND DEVIATION ANALYSIS	9

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.

UNIT III	DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS	

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

Unit IV	INFORMATION DASHBOARD DESIGN	9

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

Unit V	VISUALIZATION LIBRARIES	9

Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together Unveiling the dashboard.

TEXT BOOK(S)

1.	Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008
2.	Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.

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3.	Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.

REFERENCE(S)

1.	Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
2.	Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
3.	Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VIII
Course Code	**Course Name**	**Hours / Week**			**Credit**	**Total Hours**	**Maximum Marks**	
		L	T	P	C			
19CSPE32	**REAL TIME SYSTEMS**	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- Familiarize with various performance measure and scheduling algorithms
- Characterize a good real-time programming language
- Understand real time databases
- Provide an effective communication between various devices of a real time system
- Be familiarize with real time reliability techniques

Course Outcomes: At the end of this course, learners will be able to
- Apply different scheduling algorithm
- Analyze suitable programming constructs according to the specification
- Use real time databases for efficient storage
- Apply real time communication techniques and Fault tolerance techniques in networks
- Exploit reliability in real time applications

Unit I	INTRODUCTION	8

Introduction – Issues in Real Time Computing – Structure of a Real Time System – Task Classes – Performance Measures for Real Time Systems – Estimating Program Runtimes – Task Assignment and Scheduling – Classical Uniprocessor Scheduling Algorithms – Uni-processor Scheduling of IRIS Tasks – Task Assignment - Mode Changes – Fault Tolerant Scheduling

Unit II	PROGRAMMING LANGUAGES AND TOOLS	10

Desired Language characteristics- Data Typing- Control structures- Facilitating Hierarchical Decomposition Packages- Run-time Exception- Error handling- Overloading and Generics- Multitasking- Low Level Programming Task scheduling- Timing Specifications- Programming Environments- Run-time Support.

UNIT III	REAL TIME DATABASES	

Basic Definition- Real time Vs General Purpose Databases- Main Memory Databases- Transaction priorities Transaction Aborts- Concurrency Control Issues- Disk Scheduling Algorithms- Two-Phase Approach to improve Predictability- Maintaining Serialization Consistency- Databases for Hard Real Time systems

Unit IV	COMMUNICATION	9

Real-Time Communication – Communications Media- Network Topologies Protocols- Fault Tolerant Routing. Fault Tolerance Techniques – Fault Types- Fault Detection – Fault Error containment - Redundancy- Data Diversity Reversal Checks- Integrated Failure handling

Unit V	EVALUATION TECHNIQUES	9

Reliability Evaluation Techniques: Obtaining Parameter Values- Reliability Models for Hardware Redundancy Software Error Models – Clock Synchronization: Clocks - Impact of Faults- Fault Tolerant Synchronization in Hardware- Fault Tolerant Synchronization in Software

TEXT BOOK(S)

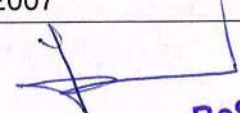| 1.	C.M. Krishna, Kang G. Shin, "Real-Time Systems", McGraw-Hill International Editions, Third Reprint, 2010.
2.	Philip.A.Laplante "Real Time System Design and Analysis" PHI, Third Edition, April 2011.

REFERENCE(S)

1.	Phillip A. Laplante, Seppo J. Ovaska, "Real-Time Systems Design and Analysis: Tools for the Practitioner", John Wiley & Sons, Third Edition, 2011.
2.	Rajib Mall, "Real time systems: theory and practice", Pearson Education, 2009
3.	Jane W. S. Liu, "Real - time Systems", Prentice Hall, 2000

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Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	VIII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE33	DESIGN PATTERN	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to
- Understand the common design patterns.
- Learn to code using creational patterns.
- Study the various structural patterns.
- Learn to identify appropriate behavioral patterns.
- Learn the architectural patterns for software architecture.

Course Outcomes: At the end of this course, learners will be able to
- Select appropriate design patterns for solving the real world problems
- Design code using creational Patterns.
- Design Software by following standard principles/practices using structural patterns.
- Select and apply suitable behavioral patterns in specific contexts.
- Follow Architectural Patterns while deciding on the software architecture.

Unit I	INTRODUCTION TO DESIGN PATTERNS	9

Introduction - Design Pattern - Design Patterns in Smalltalk MVC - Describing Design patterns - Catalog of Design Patterns - Organizing the Catalog - How Design Patterns Solve Design Problems - How to select a Design Pattern - How to use a Design Pattern.

Unit II	CREATIONAL PATTERNS	9

Abstract Factory - Builder - Factory Method - Prototype - Singleton - Case Studies applying Creational Patterns.

UNIT III	STRUCTURAL DESIGN PATTERNS	

Adapter - Bridge - Composite - Decorator - Facade - Flyweight - Proxy - Case Studies applying Structural Patterns

Unit IV	BEHAVIORAL DESIGN PATTERNS	9

Chain of Responsibility - Command - Interpreter - Iterator - Mediator - Memento - Observer - State - Strategy - Template Method - Visitor - Case Studies applying Behavioral Patterns.

Unit V	ARCHITECTURAL PATTERNS	9

Patterns: Categories, Relationships, Description, Patterns and Software Architecture - Architectural Patterns: Layers, Pipes and Filters, Blackboard - Distributed Systems: Broker

TEXT BOOK(S)

1.	Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable objectoriented software", Pearson, 2015.
2.	Frank Bachmann, Regine Meunier, Hans Rohnert "Pattern Oriented Software Architecture" Volume 1, 2008

REFERENCE(S)

1.	Mark Grand ," Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, Volume 1", Second edition, Wiley, 2002
2.	William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.
3.	Christopher G. Lasate, "Design Patterns", Wordware Publishing Inc, 2007

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	Semester	VIII
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CSPE34	QUANTUM COMPUTING	3	0	0	3	45	100	

Course Objective (s):
- Understand the building blocks of a quantum computer.
- Understand the principles, quantum information and limitation of quantum operations formalizing.
- Gain knowledge about the quantum error and its correction.

Course Outcomes:
At the end of this course, learners will be able to:
- Explain the basic concepts of quantum computing.
- Explain the quantum model of computation
- Describe quantum mechanics
- Explore the quantum computing algorithms and operations.
- Describe the quantum computational complexity and physical realization

Unit I	FOUNDATION	9

Overview of traditional computing - Church-Turing thesis - circuit model of computation reversible computation - quantum physics - quantum physics and computation – Dirac notation and Hilbert Spaces - dual vectors - operators - the spectral theorem - functions of operators - tensor products – Schmidt decomposition theorem

Unit II	QUBITS AND QUANTUM MODEL OF COMPUTATION	9

State of a quantum system - time evolution of a closed system - composite systems - measurement - mixed states and general quantum operations - quantum circuit model -quantum gates - universal sets of quantum gates – unitary transformations – quantum circuits.

Unit III	QUANTUM ALGORITHMS-I	9

Super dense coding - quantum teleportation - applications of teleportation – probabilistic versus quantum algorithms - phase kick-back - the Deutsch algorithm - the Deutsch- Jozsa algorithm - Simon's algorithm - Quantum phase estimation and quantum Fourier Transform – eigen value estimation.

Unit IV	QUANTUM ALGORITHMS-II	9

Order-finding problem – eigen value estimation approach to order finding - Shor's algorithm for order finding - finding discrete logarithms - hidden subgroups - Grover's quantum search algorithm – amplitude amplification - quantum amplitude estimation - quantum counting - searching without knowing the success probability

Unit V	QUANTUM COMPUTATIONAL COMPLEXITY AND ERROR CORRECTION	9

Computational complexity - black-box model - lower bounds for searching - general black-box lower bounds - polynomial method - block sensitivity - adversary methods - classical error correction - classical three-bit code - fault tolerance-quantum error correction - three- and nine-qubit quantum codes - fault-tolerant quantum computation-Physical realization of quantum computers.

TEXT BOOK(S)	
1.	P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press, 1999

REFERENCE(S)	
1.	V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing Company, 2007
2.	M. A. Nielsen & I.Chuang, "Quantum Computation and Quantum Information", Cambridge University Press (2000)

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OPEN ELECTIVES OFFERED BY CSE

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CSOE01	Web Development using .NET		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE02	Fundamentals of Open Source Software		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE03	Machine Learning using R		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE04	Fundamentals of Cloud Computing		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE05	BigData		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE06	Principles of User Interface Design		1,2,3,4, 5,12		3	0	0	3	40	60	100	OE
19CSOE07	Fundamentals of Database Management Systems		1,2,3,4, 12		3	0	0	3	40	60	100	OE
19CSOE08	Operating Systems Fundamentals		1,2,3,4, 12		3	0	0	3	40	60	100	OE
19CSOE09	Java Programming		1,2,3,4, 12		3	0	0	3	40	60	100	OE

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE01	WEB DEVELOPMENT USING .NET	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Understand the foundations of CLR execution.
- Learn the technologies of the .NET framework.
- Know the object oriented aspects of C#.
- Be aware of application development in .NET.
- Learn web based applications on .NET (ASP.NET).

Course Outcomes:

At the end of this course, learners will be able to:

- List the major elements of the .NET frame work and explain how C# fits into the .NET platform.
- Understand Object based concept of C#
- Debug, compile, and run a simple application.
- Analyze the basic structure of a C# application and web based development of C#
- Discuss CLR and security in .NET.

Unit I	INTRODUCTION TO C#	9

Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing

Unit II	OBJECT ORIENTED ASPECTS OF C#	9

Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading

Unit III	APPLICATION DEVELOPMENT ON .NET	9

Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration

Unit IV	WEB BASED APPLICATION DEVELOPMENT ON .NET	9

Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

Unit V	CLR AND .NET FRAMEWORK	9

Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

REFERENCE(S)

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1.	Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill, 2012.
2.	Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012
3.	Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
4.	Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSPE02	FUNDAMENTALS OF OPEN SOURCE SOFTWARE	3	0	0	3	45	100

Course Objective (s):
- Impart knowledge on Opensource system and its benefits in application development
- learn different open source system such as Language, Database and operation system
- Develop web based applications using open source system

Course Outcomes:

At the end of this course, learners will be able to:
- Understand Open Source Software tools and techniques to develop applications
- Analyze the advantages and disadvantages of Open Source tools and languages with respect to proprietary Software
- Apply the Open Source Software in developing web based Applications and Internet of Things

Unit I	INTRODUCTION TO OPEN SOURCE OPERATING SYSTEMS	9

Introduction to Open Sources - Need of Open Sources -Advantages of Open Sources Application of Open Sources - Sources LINUX Introduction General Overview Kernel Mode and User Mode Process - Advanced Concepts -Scheduling - Personalities - Cloning - Signals -Development with Linux.

Unit II	OPEN SOURCES DATABASE	9

MySQL: Introduction - Setting up account - Starting, Terminating and Writing your Own SQL programs- Record Selection Technology - Working with Strings - Date and Time - sorting Query Results - Generating Summary - Working with metadata - Using Sequences - MySQL and Web.

Unit III	CONFIGURING SERVERS	9

Setting up email servers-- using postfix (SMTP services), courier (IMAP & POP3 services), squirrel mail (web mail services) Setting up file services -- using samba (file and authentication services for windows networks), using NFS (file services for gnu/Linux /Unix networks) ; Setting up proxy services -- using squid (http / ftp / https proxy services) ; Setting up printer services -using CUPS (print spooler), foomatic (printer database).

Unit IV	FIREWALL, BUILD SYSTEM, CVS	9

Setting up a firewall - Using netfilter and ip tables; Using the GNU Compiler Collection – GNU compiler tools ; the C preprocessor (cpp), the C compiler (gcc) and the C++ compiler (g++), assembler (gas) ; Understanding build systems -- constructing make files and using make, using autoconf and autogen to automatically generate make files tailored for different development environments ; Using source code versioning and management tools -- using CVS to manage source code revisions, patch & diff.

Unit V	SERVER TECHNOLOGIES	9

Web Server: Apache Server - Working with Web Server - Configuring and Using Apache Web Services - MDA - Introduction to MDA - Geneses of MDA - MDA Applications

TEXT BOOK(S)	
1.	N. B. Venkateshwarlu (Ed); Introduction to Linux: Installation and Programming,B S Publishers; 2005
2.	Peter Wainwright, Professional Apache. Wrox Press, New Delhi, 2010
3.	M. N. RAO,Fundamentals of Open Source Software,PHI Learning Private Limited,2015

REFERENCE(S)	
1.	H.S. Lahman Model-Based Development: Applications 1st edition Pearson Education Inc,2011
2.	Stephen J. Mellor, Marc Balces, "Executable UMS: A foundation for MDA", Addison,2002.

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE03	MACHINE LEARNING USING R	3	0	2	3	60	100

Course Objective (s):

- Understand and Appreciate why data science is gaining importance in today's business world.
- Comprehend where data science can be applied in different scenarios across industry domains.
- Understand the fundamentals of R language and its usage for statistical computing
- Identify various data importing, manipulation, visualization techniques in R and perform exploratory data analysis
- Recognize various machine learning techniques such as classification, regression etc. across several use cases

Course Outcomes:

At the end of this course, learners will be able to:

- Explain why, where, how and what Machine Learning is.
- Recognize various Machine Learning Techniques.
- Apply Machine Learning techniques such as classification, regression.
- Explore advanced Machine Learning techniques like Support Vector Machines
- Apply Deep Learning Algorithms
-

Unit I	INTRODUCTION TO DATA SCIENCE AND MACHINE LEARNING	5

Digital Data – Structured, Unstructured, Semi-structured data, What is Machine Learning? Why Machine Learning? Concept of Learning, Types of Machine Learning: Supervised Machine Learning, Unsupervised Machine Learning, Semi-supervised Machine Learning, Reinforcement Machine Learning, Industrial applications of Machine Learning across domains such as Healthcare, Finance, Retail etc.

Unit II	R OBJECTS: DATA HANDLING	4

Introduction to R, why R? Object, Vector, List, Factor, Matrix, Array, Data Frame, Manipulating Objects, Input/Output, R constructs

Unit III	DESCRIPTIVE STATISTICS	8

Central tendency – , Dispersion – variance, standard deviation, shape – skewness, kurtosis, percentiles, five point summary, boxplots, histograms, barplot, pie chart, scatter plot, two way tables, covariance, correlation, Chi-Square test for two way tables

Unit IV	UNSUPERVISED LEARNING - CLUSTERING	8

What is Clustering? Applications of Clustering, Similarity measures, Partition based Clustering Techniques – K means clustering, k-medoid, Hierarchical clustering, Density based clustering, Cluster validation

Unit V	SUPERVISED LEARNING: REGRESSION, CLASSIFICATION	8

What is Regression? Simple Linear Regression, Multiple Linear Regression, What is Classification? Logistic Regression, Decision Tree, k-Nearest Neighbors, Support Vector Machine

Unit VI	NEURAL NETWORKS	7

Introduction to Neural Networks, Activation functions, Learning rate, Stochastic Gradient Descent, Feed forward, Back propagation, Basics of Deep Learning Networks

HANDS-ON PROJECTS USING R	20

Data Description, Data Visualization, Correlation analysis, Clustering, Regression, Classification, Neural networks.

TEXT BOOK(S)

1.	Practical Data Science with R. Author(s): Nina Zumel, John Mount, Manning Shelter Island
2.	Introduction to Statistical Learning using R. Author(s): Trevor Hastie, Tibshirani
3.	Applied Predictive Modeling. Author(s): by Max Kuhn, Kjell Johnson

REFERENCE(S)

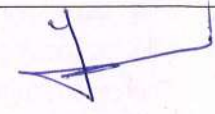|	
1.	Data Mining Concepts and Techniques, 3rd Edition. Author(s): J.Han, M Kamber, J Pei
2.	Introduction to Data Mining. Author(s): Pang-Ning Tan, Steinberg, Vipin Kumar

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE04	FUNDAMENTALS OF CLOUD COMUTING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is
- To understand the concept of cloud computing.
- To know about the cloud services .
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm and web based communication.

Course Outcomes:

At the end of this course, learners will be able to:
- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud,
- service and delivery models.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

Unit I	UNDERSTANDING CLOUD COMPUTING	9

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

Unit II	DEVELOPING CLOUD SERVICES	9

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds

Unit III	CLOUD COMPUTING FOR EVERYONE	9

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

Unit IV	USING CLOUD SERVICES	9

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files

Unit V	ADVANCED WAY TO COLLABORATE ONLINE	9

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware –

	Collaborating via Blogs and Wikis

TEXT BOOK(S)

1.	Michael Miller, Cloud Computing, 9th Edition Pearson Education, 2014
2.	Anthony T.Velte, Cloud Computing, 12th Edition, Tata Mcgraw Hill, 2013

REFERENCE(S)

1.	Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing,
2.	Applications and Data Centers in the Cloud with SLAs, Emereo Pvt Limited, July 2008

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE05	BIGDATA	2	0	2	3	60	100

Course Objective (s):

The purpose of learning this course is to
- Introduce big data technology landscape
- Understand Hadoop and its ecosystem
- Work with NoSQL databases such as MongoDB and Cassandra
- Understand pig and Hive
- Understand the basics of enterprise reporting using open source tools.

Course Outcomes:

At the end of this course, learners will be able to:
- Understand the basics of Big Data & Understand the Hadoop eco system
- Write Map Reduce Program
- Install and Use NoSQL databases
- Write Pig Scripts and Hive Query to access NoSQL data
- Generate Report using Open Source Tools

Unit I	INTRODUCTION TO BIG DATA	3

Classification of Digital Data, Introduction to Big Data- Characteristics of Data, Evolution of Big Data, Definition of Big Data, Introduction to Big Data Analytics- What is Big Data Analytics, Classification, Challenges, Terminologies Used in Big Data Environment

Unit II	THE BIG DATA TECHNOLOGY LANDSCAPE	4

NoSQL-Types of NoSQL Databases - Why NoSQL? - Advantages of NoSQL, SQL versus NoSQL, NewSQL, Hadoop- Features of Hadoop, Key Advantages of Hadoop,Overview of Hadoop Ecosystems, Hadoop Distributions, Hadoop versus SQL, Integrated Hadoop Systems Offered by Leading Market Vendors, Cloud based Hadoop solutions

Unit III	HADOOP	7

RDBMS versus Hadoop, Distributed Computing Challenges, Hadoop Overview, Hadoop Distributed File System, Processing Data with Hadoop, Managing Resources and Application with Hadoop YARN, Hadoop Ecosystem

Unit IV	NOSQL- MONGODB AND CASSANDRA	7

MongoDB- Terms used in RDBMS and MongoDB, Data Types in MongoDB, CRUD (Create, Read, Update and Delete)

Cassandra - Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD, Collections, Using a Counter, Time To Live (TTL), Alter table data, Import and Export, System Tables.

Unit V	HIVE, PIG, REPORTING TOOL	9

Hive - Hive Architecture, Data Types, File Format, Hive Query Language, RCFILE Implementation, SERDE, UDF

Pig - Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Type, Piggy Bank, UDF

(User Defined Function), Parameter Substitution, Diagnostic Operator
Jasper Report - Introduction to JasperReports, Jaspersoft Studio, Connecting to MongoDB
NoSQL database, Connecting to Cassandra NoSQL Databases

HANDS ON (30 Hours)

A project that allows the students to apply Technical, Behavioral, Process concepts learnt in the elective course by:

- Executing near real-life project (with large data)
- Working in teams (project teams will ideally comprise of 4 members)
- Experiencing expectations from different roles

There will be 1 projects (at the end of the course)

- Project 1: Data in disparate data sources such as Excel, text file, databases etc. will be provided to the students. They will be expected to extract, cleanse, integrate and load it into the data-warehouse.

Project 2: Design reports according to given business scenarios. The data for the report s is to be pulled from the data-warehouse built in the earlier project.

TEXT BOOK(S)

1.	Big Data and Analytics – Seema Acharya and Subhashini C – Wiley India
2..	Big data for dummies - Judith Hurwitz, Alan Nugent,Fern Halper, Marcia Kaufman
3.	Hadoop: The Definitive Guide by Tom White

REFERENCE(S)

1.	Hadoop in action – Chuck Lam.
2.	Hadoop for dummies - Dirk Deroos, Paul C. Zikopoulos, Roman B. Melnyk,Bruce Brown

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE06	PRINCIPLES OF USER INTERFACE DESIGN	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice Markup Language.
- To understand and practice Embedded Dynamic Scripting on Client-side Internet Programming.
- To understand and practice Web Development Techniques on client-side.

Course Outcomes:

At the end of this course, learners will be able to:

- Acquire knowledge about functionalities of World Wide Web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client-side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Able to design Front-end web page.

Unit I	INTRODUCTION TO WWW	6

Introduction to Computer networks - Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages.

Unit II	UI DESIGN	12

HTML5: What is HTML5 - Features of HTML5 – Semantic Tags – New Input Elements and tags - Media tags (audio and video tags) – Designing Graphics using Canvas API - Drag and Drop features – Geolocation API - Web storage (Session and local storage). CSS3: What is CSS3 – Features of CSS3 – Implementation of border radius, box shadow, image border, custom web font, backgrounds - Advanced text effects(shadow) - 2D and 3D Transformations - Transitions to elements - Animations to text and elements

Unit III	RESPONSIVE WEB DESIGN (RWD)	9

Responsive Design: What is RWD – Introduction to RWD Techniques – Fluid Layout, Fluid Images and Media queries - Introduction to RWD Framework. Twitter Bootstrap – Bootstrap Background and Features - Getting Started with Bootstrap - Demystifying Grids – Off Canvas - Bootstrap Components - JS Plugins - Customization

Unit IV	INTRODUCTION TO JAVASCRIPT	12

Introduction - Core features - Data types and Variables - Operators, Expressions and Statements - Functions & Scope - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling – Browser Object Model - Windows and Documents - Form handling and validations.

Object-Oriented Techniques in JavaScript - Classes – Constructors and Prototyping (Sub classes and Super classes) – JSON – Introduction to AJAX.

Unit V	INTRODUCTION TO JQUERY	6

Introduction – jQuery Selectors – jQuery HTML - Animations – Effects – Event Handling – DOM – jQuery DOM Traversing, DOM Manipulation – jQuery AJAX

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PRACTICAL (15 Hours)

- Student should develop User Interface for Real time applications

TEXT BOOK(S)

1.	Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011.
2..	Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013
3.	Bear Bibeault and Yehuda Katz, "jQuery in Action", January 2008
4.	Web link for Responsive Web Design - https://bradfrost.github.io/this-is-responsive/

REFERENCE(S)

1.	Achyut S Godbole and Atul Kahate, "Web Technologies", Second Edition, Tata McGraw Hill, 2012.
2.	David Flanagan, "JavaScript: The Definitive Guide, Sixth Edition", O'Reilly Media, 2011
3.	Ebook link for JavaScript https://github.com/jasonzhuang/tech_books/tree/master/js

Department	COMPUTER SCIENCE AND ENGINEERING				R 2019	Semester	IV
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE07	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to
- Learn data modeling using the entity-relationship and developing database designs.
- Understand the use of Structured Query Language (SQL) and learn SQL syntax.
- Apply normalization techniques to normalize the database
- Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Course Outcomes:

At the end of this course, learners will be able to
- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
- Familiar with basic database storage structures and access techniques

Unit I	INTRODUCTION TO DBMS	9

History and motivation for database systems; components of database systems; DBMS functions; database architecture and data independence.

Unit II	BASICS OF DATA MODELING	9

Data modeling; conceptual models; object -oriented model; relational data model.; Database query languages: Overview of database languages; SQL; query optimization; 4th-generation environments; embedding nonprocedural queries in a procedural language;

Unit III	RELATIONAL DATABASES	9

Mapping conceptual schema to a relational schema; entity and referential integrity; relational algebra and relational calculus; Relational database design: Database design; functional dependency; normal forms; multi valued dependency; join dependency; representation theory.

Unit IV	TRANSACTION PROCESSING	9

Transactions; failure and recovery; concurrency control

Unit V	PHYSICAL DATABASE DESIGN	9

Storage and file structure; indexed files; hashed files; signature files; b -trees; files with dense index; files with variable length records; database efficiency and tuning.

TEXT BOOK(S)

1.	A. Silberschatz, H. F. Korth & S. Sudershan, Database system concepts, McGraw Hill, 6th Edition 2010.
2.	C. J. Date, An introduction to database systems, Addison Wesley,8 th Edition, 2003.

REFERENCE(S)

1.	R. Elmasri & S. B. Navathe, Fundamentals of database systems, Addison Wesley, 6th Edition, 2011.
2.	H. Garcia et al., Database system implementation, Prentice Hall,2000

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE08	OPERATING SYSTEMS FUNDAMENTALS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the basic concepts of operating system.
- To familiarize the OS services that assist system users
- To expose several aspects of OS design including: process, deadlocks and File systems. CPU scheduling and Process synchronization,
- To learn the memory management

Course Outcomes:

At the end of this course, learners will be able to:

- Understand the basic OS principles
- Determine the efficiency of CPU Scheduling algorithms
- Detect and model Deadlock
- Implement Process Synchronization techniques.
- Simulate Memory management techniques.

Unit 1	OS OVERVIEW AND STRUCTURE	9

introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems. Operating system services and systems calls, system programs, operating system structure, operating systems generations.

Unit 2	PROCESS MANAGEMENT	6

Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming, threads in UNIX, comparison of UNIX and windows

Unit 3	PROCESS SYNCHRONIZATION & DEAD LOCK	12

Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosophers problem, monitors, synchronization examples(Solaris), atomic transactions. Comparison of UNIX and windows. deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm

Unit 4	MEMORY MANAGEMENT	9

Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, allocation of frames, thrashing, case study - UNIX.

Unit 5	FILE SYSTEMS	9

Concept of a file, access methods, directory structure, file system mounting, file

sharing, protection. File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance, comparison of UNIX and windows.

TEXT BOOKS

1.	Abraham Silberschatz, Peter B.Galvin, Greg Gagne, Operating System Concepts. Ninth edition. Addison-Wesley(2015)
2.	William Stallings, "Operating Systems-Internals and Design Principles", Sixth Edition, Pearson Prentice Hall(2009).

TEXT BOOKS

1.	Harvey M.Deitel, Paul J. Deitel, David R. Choffnes, "Operating systems", Third edition, Pearson Prentice Hall(2007).
2.	Andrew S. Tanenbaum, Albert S. Woodhull "Operating systems: design And implementation", Third Edition, Pearson Prentice Hall (2006)

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Department	COMPUTER SCIENCE AND ENGINEERING					R2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19CSOE09	JAVA PROGRAMMING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the basics of Exception Handling & Multi threading
- Know how to handle events

Course Outcomes:

At the end of this course, learners will be able to:

- Write Java application programs using OOP principles and proper program structuring
- Demonstrate the concepts of Packages and inheritance
- Write Java programs to implement error handling techniques using exception handling
- Develop application using multi threading
- Write a program using IO Streaming

Unit 1	Java Basics	9

History of Java – Difference between C++ and Java = Byte Code – JVM – Java Environment - The Java Buzz Words - Data Types – Variables – Type Conversion and Casting Arrays : One Dimensional – Multi Dimensional – Alternate Array Declaration -Operators – Control Statements : Selection (if, switch), Iteration Statements(while, do-while, for , nested loops)- Jump Statements(break, continue, return – Oracle Java Certifications Questions

Unit 2	Object Oriented Programming Basics	9

OOP Principles - Class Fundamentals – Declaring Objects -Methods – Constructors- Constructor Overloading this – Garbage Collection – finalize()- Method Overloading – Object as Parameters – Returning Objects – Access Control – Understanding static(variable, method, block) - Command line Arguments – Oracle Java Certification Questions

Unit 3	Inheritance and Packages	9

Inheritance basics – extends - using super – Multi level inheritance – Method Overriding - Constructors in Multilevel Inheritance- Dynamic Method dispatch – Abstract class – final – Packages : Understanding CIASSPATH – Creating and Accessing Packages – Access Protection in Packages – Oracle Java Certification Questions

Unit 4	Interfaces, Exception Handling and Threads	9

Interface : Defining Interface – Implementing Interfaces - extending Interface - Exception Handling : Exception fundamentals – uncaught exception – exception types – exception hierarchy- using try and catch– throw, throws, finally – user defined exception- Java Thread Model – Main Thread – Creating Thread – Thread Methods – Thread priorities – Creating multiple threads – isAlive() and join() – Oracle Java Certification Questions

Unit 5	String Handling and IO Streaming	9

String Constructors - Creating String object- String concatenation with other data types – Character Extraction Methods – String Comparison - Modifying a String – Searching String – StringBuffer IOStreaming :Character Streams and Byte Streams – Reading and Writing Characters and Strings – Reading and Writing Files – Oracle Java Certification Questions

TEXT BOOKS	
1.	The Complete Reference, Java 2 (11TH Edition Edition), Herbert Schild, TMH
2.	Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education

REFERENCE(S)	
1.	E. Balagurusamy, Java Programming with premier, second edition, Tata Mcgraw Hill, 2016.
2.	KEN ARNOLD, Java Programming Language, Addison Wesely, 2000
3.	John R Hubbard, Programming with Java, Tata Mcgraw Hill, 1998

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