PROGRAMME OUTCOMES (POs)

POs	Program Outcomes (POs)
PO1	**Engineering Knowledge:** Apply knowledge of **mathematics, science**, **engineering fundamentals** and an **Engineering Specialization** to the solution of complex engineering problems.
PO2	**Problem Analysis: Identify**, **formulate, review research literature** and **analyze complex engineering** problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design / Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO's	PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO1	An ability to apply design and development principles in the construction of software systems of varying complexity.
PSO2	The use of current application software, the design and use of operating systems and the analysis, design, testing, and documentation of computer programs for the use in information engineering technologies.
PSO3	The design techniques, analysis and the building, testing, operation and maintenance of networks, databases, security and computer systems (both hardware and software).

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
PEO1	Graduates will demonstrate technical competency and leadership skills to lead a successful career in the field of IT & ITES.
PEO2	Graduate will exhibit a commitment to communicate effectively in diverse environment and apply proficiency towards societal issue with human values.
PEO3	Graduates will pursue lifelong learning in generating innovative solutions to the changing industrial needs using research and problem solving skills.

CURRICULUM STRUCTURE

S.NO	CATEGORY	CREDITS (Regular)	CREDITS (Lateral)
A.	Foundation Courses		
	Humanities and Social Science (HSS)	13	9
	Basic Science (BS)	23	7
	Engineering Science (ES)	22	7
B.	Professional Core Courses (PC)	60	52
C.	Professional Elective courses (PE)	18	18
D.	Open Elective Courses (OE)	12	12
E.	Project, Seminar, Internship in industry or at Higher Learning institutions (PROJ)	13	13
F.	Mandatory Courses prescribed by AICTE/UGC Not to be included for CGPA (MC)		
	TOTAL	**161**	**118**

CURRICULUM SYLLABUS – Regulation 2019

SEMESTER - I

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	I	191HS101	English for Engineering Students	HSS	3	0	0	3
2	I	191CH101	Engineering Chemistry	BS	3	0	0	3
3	I	191MA101	Engineering Mathematics - I	BS	2	2	0	3
4	I	191PH101	Engineering Physics	BS	3	0	0	3
5	I	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
6	I	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
7	I	191CH10A	Chemistry Laboratory	BS	0	0	2	1
8	I	191PH10A	Physics Laboratory	BS	0	0	2	1
9	I	191ME11A	Engineering Practices Laboratory	ES	0	0	4	2
			Total		17	2	8	22

SEMESTER – II

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	II	191HS201	Environmental Science and Engineering	HSS	3	0	0	3
2	II	191MA201	Engineering Mathematics - II	BS	2	2	0	3
3	II	191EC212	Digital System Design	ES	2	2	0	3
4	II	191ME211	Engineering Graphics	ES	2	2	0	3
5	II	191CS211	Problem Solving and Python Programming	PC	3	0	0	3
6	II	191IT221	Information Technology Essentials	PC	3	0	0	3
7	II	191EC21B	Digital Systems Laboratory	ES	0	0	2	1
8	II	191CS21A	Problem Solving and Python Programming Laboratory	PC	0	0	2	1
9	II	191IT22A	Information Technology Essentials Laboratory	PC	0	0	2	1
			Total		15	6	6	21

SEMESTER – III

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	III	191HS301	Management Science	HSS	2	0	0	2
2	III	191MA306	Differential Calculus	BS	2	2	0	3
3	III	191EC312	Analog and Digital communication	ES	3	0	0	3
4	III	191CS321	Data Structures	PC	3	0	0	3
5	III	191CS322	Computer Architecture	PC	2	2	0	3
6	III	191CS323	Object Oriented Programming	PC	2	2	0	3
7	III	191HS30B	Inter Personal Skills Listening & Speaking	HSS	0	0	2	1
8	III	191CS32A	Data Structures Laboratory	PC	0	0	2	1
9	III	191CS32B	Object Oriented Programming Laboratory	PC	0	0	2	1
			Total		14	6	6	20

SEMESTER – IV

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	IV	191MA403	Discrete Mathematics	BS	2	2	0	3
2	IV	191CS421	Design and Analysis of Algorithms	PC	3	0	0	3
3	IV	191CS422	Database Management Systems	PC	3	0	0	3
4	IV	191CS423	Operating Systems	PC	2	2	0	3
5	IV	191IT421	Software Engineering and Design	PC	3	0	0	3
6	IV	191HS40C	Professional Communication	HSS	0	0	2	1
7	IV	191CS42A	Database Management Systems Laboratory	PC	0	0	2	1
8	IV	191CS42B	Operating Systems Laboratory	PC	0	0	2	1
9	IV	191MC45A	Internship /Training - I	MC				**
			Total		**13**	**4**	**6**	**18**

SEMESTER – V

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	V	191HS501	Total Quality Management	HSS	3	0	0	3
2	V	191MA502	Probability and Statistics	BS	2	2	0	3
3	V	191EC511	Micro Processor & Micro Controller	ES	3	0	0	3
4	V	191IT521	Computer Networks	PC	3	0	0	3
5	V	191IT522	Web Technology	PC	3	0	0	3
6	V		Open Elective - I	OE	3	0	0	3
7	V	191EC51A	Micro Processor & Micro Controller Laboratory	ES	0	0	2	1
8	V	191IT52A	Web Technology Laboratory	PC	0	0	2	1
9	V	191IT52B	Networks Laboratory	PC	0	0	2	1
10	V	191MC56A	Technical Seminar	MC				**
			Total		**17**	**2**	**6**	**21**

SEMESTER – VI

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	VI	191CS621	Artificial Intelligence	PC	3	0	0	3
2	VI	191IT622	Cloud Computing	PC	3	0	0	3
3	VI	191IT623	Internet of Things	PC	3	0	0	3
4	VI		Professional Elective - I	PE	3	0	0	3
5	VI		Professional Elective - II	PE	3	0	0	3
6	VI		Open Elective - II	OE	3	0	0	3
7	VI	191IT62A	Cloud Computing Laboratory	PC	0	0	2	1
8	VI	191IT62B	Software Engineering Practices Laboratory	PC	0	0	2	1
9	VI	191IT67A	Mini Project	PW	0	0	2	1
10	VI	191MC66A	Internship - II	MC				**
			Total		**18**	**0**	**6**	**21**

SEMESTER – VII

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	VII	191IT721	Mobile Application Development	PC	3	0	0	3
2	VII	191CS722	Cryptography and Network Security	PC	3	0	0	3
3	VII		Professional Elective - III	PE	3	0	0	3
4	VII		Professional Elective - IV	PE	3	0	0	3
5	VII		Professional Elective - V	PE	3	0	0	3
6	VII		Open Elective - III	OE	3	0	0	3
7	VII	191IT72A	Mobile Application Development Laboratory	PC	0	0	2	1
8	VII	191CS72B	Security Laboratory	PC	0	0	2	1
9	VII	191IT77A	Project Work - Phase I	PW	0	0	4	2
Total					18	0	8	22

SEMESTER – VIII

S.No	Semester	Course Code	Name of the Course	Category	No of Hours/Week			C
					L	T	P	
1	VIII		Professional Elective - VI	PE	3	0	0	3
2	VIII		Open Elective - IV	OE	3	0	0	3
3	VIII	191IT87A	Project Work - Phase II	PW	0	0	20	10
Total					6	0	20	16

Total Credits   161

IT- Professional Electives

Semester	Professional Elective	Course Code	Name of the Course	Category	L	T	P	C
VI	I	191IT631	Advance Database Technologies	PE	3	0	0	3
VI		191IT632	Big Data Analytics	PE	3	0	0	3
VI		191IT633	C# & .Net Programming	PE	3	0	0	3
VI		191IT634	Embedded Systems	PE	3	0	0	3
VI		191IT635	Information Theory & Coding	PE	3	0	0	3
VI		191IT636	Open Source Programming	PE	3	0	0	3
VI	II	191IT637	Advanced Java Programming	PE	3	0	0	3
VI		191IT638	Digital Image Processing	PE	3	0	0	3
VI		191IT639	Information Retrieval Systems	PE	3	0	0	3

VI		191IT6310	Mobile Computing	PE	3	0	0	3
VI		191IT6311	Multimedia Databases	PE	3	0	0	3
VI		191IT6312	Wireless Sensor and Mesh Networks	PE	3	0	0	3
VII	III	191IT731	Block chain Technologies	PE	3	0	0	3
VII		191IT732	Human Computer Interaction	PE	3	0	0	3
VII		191IT733	Semantic Web	PE	3	0	0	3
VII		191IT734	Service Oriented Architecture	PE	3	0	0	3
VII		191IT735	Soft Computing	PE	3	0	0	3
VII		191IT736	Visualization Techniques	PE	3	0	0	3
VII	IV	191IT737	Computational Linguistics	PE	3	0	0	3
VII		191IT738	Data Mining Techniques	PE	3	0	0	3
VII		191IT739	Deep Learning	PE	3	0	0	3
VII		191IT7310	Machine Learning	PE	3	0	0	3
VII		191IT7311	Network Programming and Management	PE	3	0	0	3
VII		191IT7312	Software Testing	PE	3	0	0	3
VII		191EEC731	Professional Readiness For Innovation Employability And Entrepreneurship	PE	3	0	0	3
VII	V	191IT7313	Ethical Hacking	PE	3	0	0	3
VII		191IT7314	Full Stack Software Development	PE	3	0	0	3
VII		191IT7315	Game Programming	PE	3	0	0	3
VII		191IT7316	IoT Based Smart Systems	PE	3	0	0	3
VII		191IT7317	Pattern Recognition	PE	3	0	0	3
VII		191IT7318	Quantum Computing	PE	3	0	0	3
VIII	VI	191IT831	Cognitive Computing	PE	3	0	0	3
VIII		191IT832	Computer Forensics	PE	3	0	0	3
VIII		191IT833	Enterprise Resource Planning	PE	3	0	0	3
VIII		191IT834	Industrial Economics and Corporate Management	PE	3	0	0	3
VIII		191IT835	Next Generation Networks	PE	3	0	0	3
VIII		191HS801	Professional Ethics in Engineering	PE	3	0	0	3

LIST OF OPEN ELECTIVES OFFERED BY IT

Course Code	Name of the Course	Category	L	T	P	C
191IT541	Artificial Intelligence	OE	3	0	0	3
191IT542	Block Chain Technologies	OE	3	0	0	3
191IT543	C# and .NET Programming	OE	3	0	0	3
191IT544	Cloud Computing	OE	3	0	0	3
191IT545	Database Management Systems	OE	3	0	0	3
191IT546	Machine Learning	OE	3	0	0	3
191IT547	Mobile Computing	OE	3	0	0	3
191IT548	Software Engineering and Design	OE	3	0	0	3

OPEN ELECTIVE FROM OTHER COURSES

OPEN ELECTIVE-I

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
		THEORY		L	T	P	
1	191CE542	Air Pollution and Control Engineering	OE	3	0	0	3
2	191EE541	Basics of Electric Power Generation	OE	3	0	0	3
3	191ME542	Design Thinking	OE	3	0	0	3
4	191CE544	Foundational Course in Entrepreneurship	OE	3	0	0	3
5	191EC544	Medical Electronics	OE	3	0	0	3
6	191BM545	Principles Of Telemedicine	OE	3	0	0	3

OPEN ELECTIVE-II

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
		THEORY		L	T	P	
1	191CE541	Advanced Course in Entrepreneurship	OE	3	0	0	3
2	191BM541	Basic Of Bioinformatics	OE	3	0	0	3
3	191EE543	Electrical Machines and Applications	OE	3	0	0	3
4	191ME543	Energy Conservation and Management	OE	3	0	0	3
5	191BM543	Introduction To Biomedical Devices	OE	3	0	0	3
6	191EC541	Robotics and Automation	OE	3	0	0	3

OPEN ELECTIVE-III

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
		THEORY		L	T	P	
1	191BM544	Introduction To Human Anatomy Systems	OE	3	0	0	3
2	191EE546	Introduction to Smart Grid	OE	3	0	0	3
3	191ME546	Renewable Energy Sources	OE	3	0	0	3
4	191EC548	Satellite Communication	OE	3	0	0	3
5	191EC5410	Telecommunication Network Management	OE	3	0	0	3
6	191CE5411	Traffic Engineering and Management	OE	3	0	0	3

OPEN ELECTIVE-IV

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
		THEORY		L	T	P	
1	191EC541	Cognitive Radio	OE	3	0	0	3
2	191BM542	Electronics In Medicine	OE	3	0	0	3
3	191ME544	Lean Six Sigma	OE	3	0	0	3
4	191CE548	Municipal Solid Waste Management	OE	3	0	0	3
5	191EE548	Power Electronics and Applications	OE	3	0	0	3
6	191EC546	Speech Signal Processing	OE	3	0	0	3

OPEN ELECTIVE FROM OTHER COURSES

S.No	Course Code	Name of the Course	Category	No of Hours/Week				Suitable to study in Semester	FROM DEPT
				L	T	P	C		
		THEORY							
1	191CE542	Air Pollution and Control Engineering	OE	3	0	0	3	5-8	CIVIL
2	191EE541	Basics of Electric Power Generation	OE	3	0	0	3	5-8	EEE
3	191ME542	Design Thinking	OE	3	0	0	3	5-8	MECH
4	191CE544	Foundational Course in Entrepreneurship	OE	3	0	0	3	5-8	CIVIL
5	191EC544	Medical Electronics	OE	3	0	0	3	5-8	ECE
6	191BM545	Principles Of Telemedicine	OE	3	0	0	3	5-8	BME
7	191CE541	Advanced Course in Entrepreneurship	OE	3	0	0	3	5-8	CIVIL
8	191BM541	Basic Of Bioinformatics	OE	3	0	0	3	5-8	BME
9	191EE543	Electrical Machines and Applications	OE	3	0	0	3	5-8	EEE
10	191ME543	Energy Conservation and Management	OE	3	0	0	3	5-8	MECH
11	191BM543	Introduction To Biomedical Instruments	OE	3	0	0	3	5-8	BME
12	191EC541	Robotics and Automation	OE	3	0	0	3	5-8	ECE
13	191BM544	Introduction To Human Anatomy Systems	OE	3	0	0	3	5-8	BME
14	191EE546	Introduction to Smart Grid	OE	3	0	0	3	5-8	EEE
15	191ME546	Renewable Energy Sources	OE	3	0	0	3	5-8	MECH
16	191EC548	Satellite Communication	OE	3	0	0	3	5-8	ECE
17	191EC5410	Telecommunication Network Management	OE	3	0	0	3	5-8	ECE
18	191CE5411	Traffic Engineering and Management	OE	3	0	0	3	5-8	CIVIL
19	191EC541	Cognitive Radio	OE	3	0	0	3	5-8	ECE
20	191BM542	Electronics In Medicine	OE	3	0	0	3	5-8	BME
21	191ME544	Lean Six Sigma	OE	3	0	0	3	5-8	MECH
22	191CE548	Municipal Solid Waste Management	OE	3	0	0	3	5-8	CIVIL
23	191EE548	Power Electronics and Applications	OE	3	0	0	3	5-8	EEE
24	191EC546	Speech Signal Processing	OE	3	0	0	3	5-8	ECE

SEMESTER - I

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE		**191MA101 / ENGINEERING MATHEMATICS - I**		2	2	0	3

COURSE OBJECTIVES
✓ To develop greater knowledge and understanding of mathematics and to attain the skills necessary for success in the study of higher mathematics.

SYLLABUS		
UNIT-I	**MATRICES**	**9**
Characteristic equation, Eigen values and Eigen vectors of a real matrix, Properties of Eigen values, Cayley Hamilton theorem, Orthogonal reduction of a symmetric matrix to diagonal form, Reduction of quadratic form by orthogonal transformation, Applications.		
UNIT-II	**GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS**	**9**
Curvature, Cartesian and Polar coordinates, Centre of curvature, Circle of curvature, Evolutes and Envelopes, Applications.		
UNIT-III	**FUNCTIONS OF SEVERAL VARIABLES**	**9**
Function of two variables, Partial derivatives, Total derivative, Change of Variables, Jacobians, Taylor's expansion, Maxima and Minima, Constrained Maxima and Minima by Lagrangian Multiplier method, Applications.		
UNIT-IV	**ORDINARY DIFFERENTIAL EQUATIONS**	**9**
Linear differential equations of second and higher order with constant coefficients, Method of variation of parameters, Equations reducible to linear equations with constant coefficients : Cauchy's homogeneous linear equation and Legendre's linear equation, Simultaneous linear equations with constant coefficients, Applications.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application.
CO2	Determine the bending of family of curves using differential calculus which deals in various disciplines.
CO3	Apply partial derivatives in various engineering problems.
CO4	Identify and solve the real time problems using Linear differential equations.
CO5	Identify and solve the real time problems using higher order differential equation

TEXT BOOKS

1. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley & Sons. Singapore, 10th edition, 2012.
2. Grewal B.S, "Higher Engineering Mathematics", Khanna Publications, 42nd Edition, 2012.

REFERENCES

1. Veerarajan. T, "Engineering Mathematics I", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
2. Kandasamy.Pet.al. "Engineering Mathematics", Vol. I (4th revised edition), S. Chand & Co, New Delhi, 2000.

CO-PO & PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-	3
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-	3
CO3	3	3	2	2	-	-	-	-	-	-	-	1	2	-	3
CO4	3	3	2	2	-	-	-	-		-	-	1	2	-	3
CO5	3	3	2	2	-	-	-	-	-	-	-	1	2	-	3
CO	3	3	2	2	-	-	-	-	-	-	-	1	2	-	3

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE		**191PH101 / ENGINEERING PHYSICS**		3	0	0	3

COURSE OBJECTIVES

✓ The course aims to equip engineering undergraduates with principles of Physics in a broadersense with a view to lay foundation for the various engineering courses.

SYLLABUS

UNIT-I	PROPERTIES OF SOLIDS	9

Elasticity, Hooke's law, stress -strain diagram, Poisson's ratio, Factors affecting elasticity, Bending moment, Depression of a cantilever, Young's modulus by uniform bending, Young's modulus by non-uniform bending (Theory and Experiment), Torsional stress and twisting couple, Torsional Pendulum ((Theory and Experiment) I-shaped girders.

UNIT-II	PRINCIPLES OF LASERS	9

Properties of laser radiation and their significance-wavelength, power, monochromaticity, coherence. Types of lasers working media and their radiation characteristics-Power, wavelength and operational modes of He-Ne, Carbon-dioxide. Physical principles of Laser beam delivery systems. Applications- Industry and Medical. Selection of lasers for various applications.

UNIT-III	OPTICAL FIBRE SYSTEMS	9

Optical Fibres, Propagation mechanism, Critical Angle, Snell's Law, Total Internal Reflection, Acceptance cone, Numerical aperture, Types of fibers, Attenuation, Active and passive fibre sensors (Temperature and Displacement), Applications (Industry and Medical), communication in optical fiber,Endoscope.

UNIT-IV	WAVE NATURE OF PARTICLES	9

Introduction to Quantum mechanics, Black body radiation, Planck's Hypothesis, Compton Effect (Theory and Experiment), Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wavefunction, Schrodinger equation for one dimensional problems, particle in a box-SEM and TEM.

UNIT-V	SOLID STATE PHYSICS	9

Crystalline and non crystalline materials, Lattice, Unit cell, Bravais lattice, Lattice planes, Miller indices, Expression for inter planar spacin, Bragg's law, Diffraction of X-rays by crystal planes, Co-ordination number, Atomic packing factors (SC, FCC, BCC and HCP structures), Diamond and graphite structures (qualitative treatment) , Crystal growth techniques (Bridgman and Czochralski).

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Demonstrate the proficiency on the properties of matter and its applications
CO2	Describe the working principles of Laser and its developments in industrial and medical applications
CO3	Explain the propagation of waves in optical fibers and their applications
CO4	Apply the theory of wave nature of particles in various microscopic applications
CO5	Analyze the structure of materials and its crystal growth techniques

TEXT BOOKS

1. 'Engineering Physics', R.K. Gaur and S.L. Gupta, DhanpatRai Publications (P) Ltd., 8th Edition, New Delhi (2001).
2. Introduction to Solid State Physics, 7th Edition, Charles Kittel, Wiley, Delhi 2007.
3. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.

REFERENCES

1. Laser Fundamentals, William T. Silfvast, 2nd Edition, Cambridge University press, New York, 2004.
2. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York 2001.
3. E. Hecht, Optics, Pearson Education, 2008.

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	**191CH101 / ENGINEERING CHEMISTRY**			3	0	0	3

COURSE OBJECTIVES
✓ To acquaint the students with the development of microscopic chemistry in terms of atomic, molecular and intermolecular forces and acquires the knowledge of water treatment. The students will be able to analyze the properties and applications of polymer and advanced materials

SYLLABUS	

UNIT-I	CHEMICAL BONDING	9

Types of chemical bonds , bond polarity, dipole moment, partial ionic character, consequences. Weak Interactions, Hydrogen bonding, van der Waals forces, influence on properties of matter. Metallic bond, free electron theory, MO treatment , band theory-metals, semiconductors and insulators. Non stoichiometric semiconductors, chalgogen semiconductors. Defect structures of crystals, Schottky and Frenkel defects.

UNIT-II	WATER CHEMISTRY	9

Hardness, determination (EDTA method). Water softening, zeolite and demineralization processes. Desalination by electro-dialysis and reverse osmosis. Water analysis by fluoride ion, Water quality parameters, Instrumental methods for water analysis- AAS, flame emission spectroscopy, ICP-MS and photocolorimetry.

UNIT-III	ELECTROCHEMISTRY	9

Electrode potential, standard and reference electrodes, Nernst equation, emf series, applications. Galvanic and concentration cells. Applications of potential measurements, glass electrode, pH measurement, acid- base titration, redox titration. Conductance measurement, applications - conductometric titrations.

UNIT-IV	POLYMERS	9

Classification, degree of polymerization, molecular weight – Mn and Mw. Polymerization reactions. Glass transition temperature, factors affecting Tg, determination by DSC. Polymer processing, compounding, outline of moulding techniques compression, injection, extrusion and blow moulding. Charge transport in conjugated polymers, doped conjugated polymers, glucose biosensor. Polymers for LED and LCD displays.

UNIT-V	ADVANCED MATERIALS	9

Carbon nanotubes and carbon fibers, graphene and polymer nano-composites, properties and applications - morphological studies by SEM and TEM. Solid oxide materials and polymer electrolytes, energy storing applications. Polymer blends and alloys, photo and electroluminescence materials, insulating materials, photopolymers and photoresists for electronics, polymer photovoltaics.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Analyse microscopic chemistry in terms of atomic, molecular and Intermolecular forces for realtime applications of semiconductors.
CO2	Investigate the various water treatment and softening methods.
CO3	Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells.
CO4	Explain the basic principle, types and mechanism of polymerization process and techniques.
CO5	Assess the properties, characterization and applications of advanced materials for energystorage.

TEXT BOOKS

1. Mary Jane Shultz, "Engineering Chemistry", Cengage Learning, USA, 2009.
2. Palanna O. G., "Engineering Chemistry", Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi, 2009.

CO-PO & PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE		**191HS101/ENGLISH FOR ENGINEERING STUDENTS**		3	0	0	3

COURSE OBJECTIVES
☐ Equip students with the English language skills required for the successful undertaking of academic studies.   ☐ Improve general and academic listening skills   ☐ Provide guidance and practice in basic geranial and classroom conversation and toengage in specific academic speaking activities   ☐ Strengthen the reading and writing skills of students of engineering

SYLLABUS		
UNIT-I	**VOCABULARY BUILDING**	**9**
	Word formation, Prefixes and Suffixes, Root words from foreign languages, Synonyms, Antonyms, Compound Nouns, Standard Abbreviations.	
UNIT-II	**GRAMMATICAL COMPETENCY**	**9**
	Noun, Verb, Adjective, Subject-Verb Agreement, Articles, Prepositions, Purpose expressions, Model Verbs.	
UNIT-III	**BASIC WRITING SKILLS**	**9**
	Sentence structure, Phrases, Clauses, Coherence, Cohesion (using linking words), Paragraph Writing (Descriptive and Narrative)	
UNIT-IV	**READING SKILLS**	**9**
	Reading Strategies, Skimming and Scanning, Reading Comprehension exercises with multiple choice and open ended questions, Transforming Information in the form of charts, Note Making.	
UNIT-V	**ORAL COMMUNICATION**	**9**
	(This unit involves interactive practice sessions in Language Lab) • Listing Comprehension. • Pronunciation, Syllable and Stress, Rhythm and Intonation. • General conversations and dialogues, common in everyday situations. • Short Speech.	

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Infer meanings of unfamiliar words from context
CO2	Enable to achieve linguistic competence and be able to use grammar as a tool or resource in the comprehension and creation of oral and written discourse efficiently according to the situation
CO3	Write cohesively, coherently and flawlessly with a wide range of vocabulary and organizing their ideas logically on a topic.
CO4	Activate and reinforce the habit of reading and writing effectively in their discipline.
CO5	Collaborate with multicultural environment.

TEXT BOOKS

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", Orient Blackswan, Chennai - 2012.
2. Dhanavel S. P, "English and Communication Skills for Students of Science and Engineering", Orient Blackswan, Chennai - 2011.
3. "Communication Skills", Sanjay Kumar and PushpLata, Oxford University Press, 2011.

REFERENCES

1. "Practical English Usage", Michael Swan. OUP. 1995.
2. "Remedial English Grammar", F.T. Wood. Macmillan. 2007.
3. "Study Writing", Liz Hamp-Lyons and Ben Heasly, Cambridge University Press, 2006.
4. "Exercises in Spoken English", Parts. I-II, CIEFL, Hyderabad. Oxford University Press.
5. "Practical English Usage", Michael Swan. OUP. 1995.

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	3	3	3	3	-	-	-
CO2	-	-	-	-	-	-	-	3	3	3	3	3	-	-	-
CO3	-	-	-	-	-	-	-	3	3	3	3	3	-	-	-
CO4	-	-	-	-	-	-	-	3	3	3	3	3	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	3	3	-	-	-
CO	-	-	-	-	-	-	-	3	3	3	3	3	-	-	-

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE		191ME111 / BASIC CIVIL AND MECHANICAL ENGINEERING		3	0	0	3

COURSE OBJECTIVES

- ☐ To create awareness on fundamental knowledge on various domains of civil engineering
- ☐ To introduce the sources of water and treatment of water, sewage treatment and transportation modes
- ☐ To introduce the fundamentals of Power Plant Engineering
- ☐ To introduce the fundamentals of IC engines
- ☐ To introduce the fundamentals of Energy resources and refrigeration cycles

SYLLABUS

UNIT-I	SCOPE OF CIVIL ENGINEERING	9

Introduction, Functions and role of Civil Engineer, Branches of Civil Engineering, Materials, Properties, classification and characteristics of building stones, bricks, timber, cement and cement concrete, reinforcing steel, Components of residential building, Foundation, Types and necessity.

UNIT-II	WATER RESOURCES & ENVIRONMENTAL ENGINEERING	9

Sources of water, Hydrologic cycle, Rain water harvesting, importance, methods of rain water harvesting, Water demand estimation, Sources of water, Quality of water, Treatment of water. Water distribution. Sewerage, collection, treatment and disposal of sewage, Septic tanks.

UNIT-III	POWER PLANTS, PUMPS AND TURBINES	9

Introduction to Power Plant, Classification of Power Plants, Working principle of steam, Gas, Diesel, Hydro-electric, Geo-thermal and Nuclear Power plants, Merits and Demerits, Pumps and turbines, working principle of single acting and double acting Reciprocating pumps, Centrifugal Pump.

UNIT-IV	IC ENGINES	9

Introduction to Internal combustion engines, Working principle of Petrol and Diesel Engines, Four stroke and two stroke cycles, Comparison of four stroke and two stroke engines.

UNIT-V	RENEWABLE ENERGY AND REFRIGERATION	9

Introduction to renewable energy sources, Non renewable energy sources, Comparison of Electrical Energy Storage Technologies. Vapour compression Refrigeration system, Vapour absorption refrigeration system.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Explain the usage of construction material and proper selection of construction materials
CO2	Explain about water resources, sewage treatment and transportation systems
CO3	Explain about the components use in power plants
CO4	Describe the internal combustion engines
CO5	Explain about the renewable energy sources and refrigeration cycles

TEXT BOOKS

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co, New Delhi, 1996.

REFERENCES

1. T. Jha and S.K. Sinha, "Construction and Foundation Engineering", Khanna publishers, Delhi, 2003.
2. S.K. Garg, "Water Supply Engineering", Khanna publishers, Delhi, 2005.
3. Ramamrutham S, "Basic Civil Engineering", DhanpatRai Publishing Co.(P) Ltd. 1999.
4. Seetharaman S, "Basic Civil Engineering", Anuradha Agencies, 2005.
5. Venugopal K. and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CO1	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	1	-	-

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE		191EE111 / BASIC ELECTRICAL AND ELCTRONICS ENGINEERING		3	0	0	3

COURSE OBJECTIVES
- To understand the structure of Electric Power Systems.   - To execute safety precautions.   - To study about Electric laws.   - To know about construction of meters.   - To understand about Electronics and Communication systems.

SYLLABUS		
UNIT-I	INDIAN ELECTRICITY SCENARIO	9
Electric Power, Generation resources, Transmission types & Distribution system (levels of voltage, power ratings and statistics), Regulatory Authorities governing Indian Electricity Protection & Safety, Hazards of electricity-shock, effects of electricity on the human body. Electrical safety practices, Protection devices.		
UNIT-II	BASICS OF ELECTRICAL COMPONENTS	9
Evolution of Electricity and Electrical inventions - Charge, Electric potential, voltage, current, power, energy, DC, AC, time period, frequency, phase, flux, flux density, RMS, Average, Peak, Phasor & Vector diagram.		
UNIT-III	BASIC LAWS OF ELECTRIC SYSTEMS& MEASUREMENTS	9
Electric Circuits, Passive components (RLC), Ohm's law, KCL, KVL, Faraday's law, Lenz's law-Illustrative examples, Analog Moving Iron, Moving Coil and Digital meters, Types and usage.		
UNIT-IV	BASICS ELECTRONICS	9
Electrical Vs Electronics, Electronic products and systems, Electronic Devices (Diode–Forward bias, reverse bias, Transistor (CE, CB, CC), Electronic components, Electronic Circuits-Rectifier, Regulator &IC-Basic Amplifiers and Oscillators- Communication system Block diagram (Transmitter and Receiver).		
UNIT-V	BASICS OF COMMUNICATION ENGINEERING	9
Amplitude Modulation, AM, DSBSC, SSBSC, VSB–PSD, modulators and demodulators, Angle Modulation, PM and FM–PSD.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Summarizes about different structures of Power system and safety measures.
CO2	Explain about the basics of Electricity
CO3	Discuss on various electric circuits and use of measuring instruments
CO4	Clarify the working of basic electronic devices such as diode, transistor and operational amplifiers
CO5	Infer about Digital Electronics and Communication System

TEXT BOOKS

1. S Salivahanan Rangarajan, "Basic Electrical Electronics & Measurement Engineering", Tata McGraw Hill Publishing Co Ltd.
2. "Basic Electric Engineering", D P Kothari &Nagrath, Tata McGraw Hill.
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age international pvt.ltd.,2003.

REFERENCES

1. Albert Paul Malvino, "Electronic Principles", TataMcgrawHill, 2002.
2. Simon Haykin, "Communication Systems", Wiley Eastern, Third Edition, 1996.
3. M.S. Sukhija and T.K. Nagsarkar, "Basic Electrical and Electronic Engineering", Oxford, 2016.
4. M.Morris Mano, Digital Design, Third Edition, Pearson Publication.

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CO5	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE		191PH10A / PHYSICS LABORATORY		0	0	2	1

COURSE OBJECTIVES

✓ Students will be able to demonstrate an understanding of the scientific method, so that they mayuse the training beneficial in their higher pursuits.

LIST OF EXPERIMENT

1	Determination of Rigidity modulus – Torsion pendulum.
2	Determination of Young's modulus by non-uniform bending method.
3	Determination of Planck's Constant and work function of materials using photo electric effect experiment.
4	Determination of wavelength, and particle size using Laser.
5	Determination of acceptance angle in an optical fiber.

COURSE OUTCOMES

On completion of the course, students will be able to

1	Apply the principles of properties of matter in determining the various elastic properties
2	Determine Young's modulus by non-uniform bending method.
3	Applying Photo electric effect to determine Planks Constant.
4	Determination of wavelength of mercury spectrum – spectrometer grating.
5	Attain the practical knowledge to apply principles of optics for various engineering applications

TEXTBOOK

1.Wilson J.D. and Hernandez C.A., "Physics Laboratory Experiments", Houghton Mifflin Company, New York 2005.

CO	CO-PO & PSO Mapping
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	-	-	-	-	2	1	-	-
CO	3	3	2	2	-	2	2	-	-		-	2	1	-	-

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE		**191CH10A / CHEMISTRY LABORATORY**		0	0	2	1

COURSE OBJECTIVES
✓ To furnish the conceptual understanding of the basic principles involved in chemical analysis.
✓ To attain the analytical knowledge of students by conducting various experiments.

	LIST OF EXPERIMENTS
1	Determination of total, permanent, temporary, calcium and magnesium hardness of water by EDTA method.
2	Conductometric titration - determination of strength of an acid.
3	Estimation of iron by potentiometry.
4	Determination of molecular weight of polymer by viscosity average method.
5	Determination of dissolved oxygen in a water sample by Winkler's method.
6	Determination of Na / K in water sample by Flame photometry (Demonstration).
7	Estimation of Copper in ore.
8	Estimation of nickel in steel.
9	Determination of total alkalinity and acidity of a water sample.
10	Determination of rate of corrosion by weight loss method.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Acquire knowledge on quantitative chemical analysis by instrumentation and volumetric method.
CO2	Analyse the water sample for hardness, chloride, sodium /potassium content, dissolved oxygen etc.
CO3	Solve analytical problems in spectrometer and flame photometer for the identification and quantification.
CO4	Estimate Copper in ore and Nickel in Steel
CO5	Analyse rate of corrosion by weight loss method.

TEXTBOOK

1.Vogel's Textbook of quantitative chemical Analysis (8th edition, 2014).

CO-PO & PSO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-
CO2	3	3	2	2	-	1	1	1	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-
CO4	3	3	2	2	-	1	1	1	1	-	-	1	1	-	-
CO5	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-
CO	3	3	2	2	-	2	2	1	2	-	-	2	1	-	-

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	**191ME11A / ENGINEERING PRACTICES LABORATORY**			0	0	4	2

COURSE OBJECTIVES

✓ To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)

CIVIL ENGINEERING PRACTICE

BUILDINGS:

1	Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.

PLUMBING WORKS:

1	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
2	Study of pipe connections requirements for pumps and turbines.
3	Preparation of plumbing line sketches for water supply and sewage works.
4	Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5	Demonstration of plumbing requirements of high-rise buildings.

CARPENTRY USING POWER TOOLS:

1	Study of the joints in roofs, doors, windows and furniture.
2	Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

MECHANICAL ENGINEERING PRACTICES

WELDING:

1	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2	Gas welding practice.

BASIC MACHINING

1	Simple Turning and Taper turning.
2	Drilling Practice.

SHEET METAL WORK

1	Forming & Bending.
2	Model making – Trays and funnels.
3	Different type of joints.

MACHINE LABORATORY PRACTICES

1	Study of centrifugal pump.
2	Study of air conditioner.

DEMONSTRATION ON

1	Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
2	Foundry operations like mould preparation for gear and step cone pulley. Fitting – Exercises – Preparation of square fitting and V-fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICES

1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring.
3	Stair case wiring.
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5	Measurement of energy using single phase energy meter.
6	Measurement of resistance to earth of an electrical equipment.

ELECTRONICS ENGINEERING PRACTICE

1	Study of Electronic components and equipments - Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2	Study of logic gates AND, OR, EX-OR and NOT.
3	Generation of Clock Signal.
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5	Measurement of ripple factor of HWR and FWR.

LIST OF EXPERIMENTS	
REQUIREMENTS FOR A BATCH OF 30 STUDENTS	
CIVIL	

SI NO	DESCRIPTION OF THE EQUIPMENT	QUANTITY REQUIRED
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets
2	Carpentry vice (fitted to work bench)	15 Nos
3	Standard woodworking tools	15 Sets
4	Models of industrial trusses, door joints, furniture joints	5 Each
5	Power Tools: a) Rotary Hammer b) Demolition Hammer c) Circular Saw d) Planer e) Hand Drilling Machine f) Jigsaw	2 Nos 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos
MECHANICAL		
1	Are welding transformer with cables and holders	5 Nos
2	Welding booth with exhaust facility	5 Nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc.,	5 Nos
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5	Centre lathe	2 Nos
6	Hearth furnace, anvil and smithy tools	2 Nos
7	Moulding table, foundry tools	2 Nos
8	Power Tool : Angle Grinder	2 Nos
9	Study-Purpose items: Centrifugal pump, air-conditioner	One Each
ELECTRICAL		
1	Assorted electrical components for house wiring	15 Nos
2	Electrical measuring instruments	10 Nos

3	Study purpose items: Iron box, fan and regulator, emergency lamp	1 Nos
4	Megger (250V/500V)	1 Nos
5	Power Tools: (a) Range Finder (b) Digital Live-wire detector	2 Nos 2 Nos

ELECTRONICS		
1	Soldering guns	10 Nos
2	Assorted electronic components for making circuits	50 Nos
3	Small PCBs	10 Nos
4	Multimeters	10 Nos
5	Study purpose items: Telephone, FM radio, low-voltage power supply	

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Hands on experience on welding, sheet metal and lathe works
CO2	Experience the plumping and carpentry work and demonstration on centrifugal pump and air conditioning working principles
CO3	Measurement of Electrical quantities, earthing procedures, wiring methods etc
CO4	Study of Electronic components and equipments – Resistor, color coding measurement of AC signal parameter, Gates , Circuits etc
CO5	Provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	2	1	-	-	-	-	-	2	-	-	-
CO2	3	3	1	1	1	1	-	-	-	-	-	1	-	-	-
CO3	3	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO4	3	3	1	2	1	1	-	-	-	-	-	1	-	-	-
CO5	3	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	-	-

SEMESTER – II

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	**191MA201 / ENGINEERING MATHEMATICS II**			**2**	**2**	**0**	**3**

COURSE OBJECTIVES

- ☐ To understand double and triple integrations and enable them to find area and volume usingmultiple integrals.
- ☐ To know the basics of vector calculus comprising gradient, divergence and curl and line, surfaceand volume integrals.
- ☐ To understand analytic functions of complex variables and conformal mappings.
- ☐ To know the basics of residues, complex integration and contour integration.
- ☐ To understand Laplace transform and use it to represent system dynamic models and evaluatestheir time responses.

SYLLABUS

UNIT-I	**MULTIPLE INTEGRALS**	9

Double integration, Cartesian and polar coordinates, Change of order of integration, Triple integration incartesian coordinates.

UNIT-II	**VECTOR CALCULUS**	9

Gradient, divergence and curl, Directional derivative, Irrotational and solenoidal vector fields, Simple problems on Vector differentiation, Vector integration, Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs).

UNIT-III	**ANALYTIC FUNCTION**	9

Functions of a complex variable, Analytic functions, Necessary conditions, Cauchy Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs), Properties of analytic function, Construction of analytic function by Milne Thomson method, Conformal mapping : $w = z + c$, cz , $1/ z$, z^2 $^-$ bilinear transformation.

UNIT-IV	**COMPLEX INTEGRATION**	9

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs), Taylor's and Laurent's series expansions, Singularities, Residues, Cauchy's residue theorem (excluding proof), Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

UNIT-V	**LAPLACE TRANSFORM**	9

Laplace transform, Sufficient condition for existence, Transform of elementary functions, Basic properties, Transforms of unit step function and impulse functions, Transform of periodic functions. Inverse Laplace transform, Statement of Convolution theorem, Initial and final value theorems, Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Evaluate multiple integrals using change of variables.
CO2	Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.
CO3	Construct analytic functions of complex variables and transform functions using conformal mappings.
CO4	Estimate the real and complex integrals over suitable closed paths and contours.
CO5	Compute linear differential equations using Laplace transform techniques

TEXT BOOKS
1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Delhi, 42nd Edition, 2012. 2. Kreyzig E., "Advanced Engineering Mathematics", John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10th Edition, 2010.

REFERENCES
1. Veerarajan T, "Engineering Mathematics" (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007. 2. Venkataraman M.K, "Engineering Mathematics", Volume - II, The National Pub. Co., Chennai, 2003. 3. Kandasamy P., Thilagavathy K. and Gunavathy K, "Engineering Mathematics", S. Chand & Co., New Delhi, 2008. 4. Arunachalam T. and Sumathi K, "Engineering Mathematics II", Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO4	3	3	2	2	-	-	-	-		-	-	1	2	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	**191EC212/ DIGITAL SYSTEM DESIGN**			2	2	0	3

COURSE OBJECTIVES

- ✓ To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- ✓ To familiarize with the design of various combinational digital circuits using logic gates
- ✓ To introduce the analysis and design procedures for synchronous and asynchronous sequentialcircuits
- ✓ To explain the various semiconductor memories and related technology

SYLLABUS

UNIT-I	BOOLEAN ALGEBRA	9
Boolean Algebra - Theorems and Properties of Boolean Algebra -Digital Logic Gates – Universal gate Implementations- Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map, Quine-McCluskey (QM) Technique.		
UNIT-II	COMBINATIONAL LOGIC	9
Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers – Demultiplexer-Introduction to HDL – HDL Models of Combinational circuits		
UNIT-III	SYNCHRONOUS SEQUENTIAL LOGIC	9
Sequential Circuits - Latches , Flip-Flops - Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters - HDL Models of Sequential Circuits..		
UNIT-IV	ASYNCHRONOUS SEQUENTIAL LOGIC	9
Analysis of Asynchronous Sequential Circuits- Design of Asynchronous Sequential Circuits- Reduction of State and Flow Tables –Hazards– Design of Hazard Free Switching circuits.		
UNIT-V	MEMORY AND PROGRAMMABLE LOGIC DEVICES	9
Memory classification, STATIC RAM, DYNAMIC RAM, EPROM, EAPROM, EEPROM, Organization of PROM, Programmable Logic Array(PLA) and Programmable Array Logic (PLA) – Implementation of PLDs.		

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Apply the theorems and postulates of Boolean algebra, the techniques of Karnaugh Maps and Quine-McCluskey tabulation techniques for simplification of logic functions.
CO2	Design combinational logic circuits for various applications and implement them using logic gates or other devices like multiplexers, decoders and simulate them using Hardware Description Language (HDL).
CO3	Design synchronous sequential logic circuits like counters and shift registers and implement them using different flip flops.
CO4	Analyze the given Asynchronous sequential logic circuit to determine its function.
CO5	Implementation of PLD's and Reviewing of memory devices.

TEXT BOOKS
1. M.Morris Mano & Michael D.Ciletti, Digital Design, First impression, Pearson, 2012.

REFERENCES
1. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013 2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017. 3. Donald D. Givone, Digital Principles and Design‖, Tata McGraw Hill, 2003.

<table>
<tr><th colspan="16">CO-PO & PSO Mapping</th></tr>
<tr><th>CO</th><th>PO 1</th><th>PO 2</th><th>PO 3</th><th>PO 4</th><th>PO 5</th><th>PO 6</th><th>PO 7</th><th>PO 8</th><th>PO 9</th><th>PO 10</th><th>PO 11</th><th>PO 12</th><th>PSO 1</th><th>PSO 2</th><th>PSO 3</th></tr>
<tr><td>CO1</td><td>3</td><td>3</td><td>3</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>CO2</td><td>3</td><td>3</td><td>3</td><td>-</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>CO3</td><td>3</td><td>3</td><td>3</td><td>-</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>CO4</td><td>3</td><td>3</td><td>3</td><td>-</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td></tr>
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<tr><td>CO</td><td>3</td><td>3</td><td>3</td><td>-</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td></tr>
</table>

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE		191IT221/ INFORMATION TECHNOLOGY ESSENTIALS		3	0	0	3

COURSE OBJECTIVES
✓ To introduce the concept of Internet, Networks and its working principles. ✓ To know scripting languages. ✓ To understand various applications related to Information Technology

SYLLABUS

UNIT-I	WEB ESSENTIALS	9

Creating a Website - Working principle of a Website - Browser fundamentals - Authoring tools - Types of servers: Application Server - Web Server - Database Server.

UNIT-II	SCRIPTING ESSENTIALS	9

Need for Scripting languages - Types of scripting languages - Client side scripting - Server side scripting - PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - PHP and MySQL - PHP and HTML - Cookies - Simple PHP scripts.

UNIT-III	NETWORKING ESSENTIALS	9

Fundamental computer network concepts - Types of computer networks - Network layers - TCP/IP model - Wireless Local Area Network - Ethernet - WiFi - Network Routing - Switching - Network components

UNIT-IV	MOBILE COMMUNICATION ESSENTIALS	9

Cell phone working fundamentals - Cell phone frequencies & channels - Digital cell phone components - Generations of cellular networks - Cell phone network technologies / architecture - Voice calls & SMS-GSM

UNIT-V	APPLICATION ESSENTIALS	9

Creation of simple interactive applications - Simple database applications - Multimedia applications - Design and development of information systems – Personal Information System – Information retrieval system – Social networking applications

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Develop a web page
CO2	Design and deploy simple web application
CO3	Understand the basics of networking and mobile communication
CO4	Know the basics of mobile communication
CO5	Create simple database application.

TEXT BOOKS
1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY, 2014. 2. James F. Kurose, ―Computer Networking: A Top-Down Approach‖, Sixth Edition, Pearson, 2012

REFERENCES
1 Gottapu Sasi bhushana Rao, "Mobile Cellular Communication", Pearson, 2012. 2. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014. 3. it-ebooks.org

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	1	-	-	-	2	-	-	-	3	2	2
CO2	3	3	2	3	1	-	-	-	2	-	-	2	3	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	1	2
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	1	1
CO5	3	3	2	2	1	-	-	-	2	-	-	2	3	2	2
CO	3	3	2	2	1	-	-	-	2	-	-	2	3	2	2

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191ME211 / ENGINEERING GRAPHICS			2	2	0	3

COURSE OBJECTIVES
☐ To convey the basics of engineering drawing.   ☐ To explain the importance of an engineering drawing.   ☐ To teach different methods of making the drawing.   ☐ To establish the importance of projects and developments made in drawing that are used inreal systems.   ☐ To develop an intuitive understanding of underlying significance of using these drawings.

SYLLABUS		
UNIT-I	CURVES AND PICTORIAL VIEWS TO ORTHOGRAPHIC VIEWS	8+4
Geometrical Constructions like bisection of a straight line, division of a straight line into n equal parts, bisection of angles, Curves used in engineering practices: Conics, Construction of ellipse, parabola and hyperbola by eccentricity method, Construction of cycloid, Construction of involutes of square and circle, Drawing of tangents and normal to the above curves. Free hand sketching of multiple orthographic views from single pictorial view of objects.		
UNIT-II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	8+2
Orthographic projections, Introduction, Principles, Principal planes, First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes, Determination of true lengths and true inclinations by rotating line method, traces. Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		
UNIT-III	PROJECTION OF SOLIDS	8+2
Projection of regular solids by rotating object method when the axis is inclined to one of the principal planes.		
UNIT-IV	SECTION OF SOLIDS & DEVELOPMENT OF LATERAL SURFACES OF SOLIDS	8+4
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other obtaining true shape of the section. Development of lateral surfaces of regular and sectioned solids.		
UNIT-V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	8+4
Principles of isometric projection, Isometric scale, Isometric View, Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones, combination of two solid objects in simple vertical positions. Perspective projection of simple solids – Prisms, pyramids and cylinders by visual ray method.		

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Draw engineering curves and apply the concepts of free hand sketching
CO2	Draw orthographic views of points, lines and surfaces
CO3	Draw visualizations of simple solid objects as per orthographic projections
CO4	Draw sections and developments made in drawing
CO5	Draw pictorial drawings of simple objects

TEXT BOOKS
1. N.D. Bhatt, Engineering Drawing, 49th edition, Charotar Publishing House, 2006.

REFERENCES
1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009. 2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008 3. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008. 4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007

CO-PO & PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	-	1	-	2	-	1	1	1	2	1	1
CO2	3	3	2	2	-	1	-	2	-	1	1	1	2	1	1
CO3	3	3	2	2	-	1	-	2	-	1	1	1	2	1	1
CO4	3	3	2	2	-	1	-	2	-	1	1	1	2	1	1
CO5	3	3	2	2	-	1	-	2	-	1	1	1	2	1	1
CO	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**2**	**-**	**1**	**1**	**1**	**2**	**1**	**1**

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE		**191CS211 / PROBLEM SOLVING AND PYTHON PROGRAMMING**		3	0	0	3

COURSE OBJECTIVES

- To know the basics of algorithmic problem solving.
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

SYLLABUS

UNIT-I	ALGORITHMIC PROBLEM SOLVING	9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion) Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, Guess an integer number in a range, Towers of Hanoi.

UNIT-II	DATA, EXPRESSIONS, STATEMENTS	9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT-III	CONTROL FLOW, FUNCTIONS	9

Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT-IV	LISTS, TUPLES, DICTIONARIES	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT-V	FILES, MODULES, PACKAGES	9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, dir() functions, packages-initialization, importing a package, Subpackage; Illustrative programs: word count, copy file.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Describe the Algorithmic solutions for simple computational problems.
CO2	Identify the various data expressions, statements in python programming.
CO3	Use control flow and function for solving problems in python.
CO4	Create and manipulate items in list, tuples & dictionaries.
CO5	Develop simple programs using files, modules, packages in python..

TEXT BOOKS

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3 Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python3.2 Network Theory Ltd., 2011

REFERENCES

1. John V Guttag, ―Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, ―Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, ―Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
5. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

CO-PO&PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	-	-	-	-	-	-	-	1	3	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1	3	2	1
CO3	3	3	2	2	1	-	-	-	-	-	-	2	3	2	2
CO4	3	3	2	2	1	-	-	-	-	-	-	2	3	2	2
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	2	2
CO	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**2**

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	\multicolumn{3}{c}{191HS201 / ENVIRONMENTAL SCIENCE AND ENGINEERING}		3	0	0	3

COURSE OBJECTIVES
☐ This course provides the basic knowledge of structure and function of ecosystem and better understanding of natural resources, biodiversity and their conservation practices.
☐ It describes the need to lead more sustainable lifestyles, to use resources more equitably.
☐ It helps to create a concern for our environment that will trigger pro-environmental action, including activities we can do in our daily life to protect it.
☐ Furthermore, it deals the social issues and ethics to develop quality engineer in our country.

SYLLABUS	
UNIT-I	**ENVIRONMENT – AN OVERVIEW**	**9**

Ecosystem - concept, structure, function, types, Energy flow in ecosystem, Biodiversity and its conservation, values of biodiversity, threats to biodiversity conservation of biodiversity, Natural resources - types, uses.

UNIT-II	**ENVIRONMENTAL IMPACT OF ENERGY SOURCES**	**9**

Sources of primary energy, present and future consumption of energy, environmental impacts of energy development- oil, natural gas, coal, hydro electric, nuclear power, wind mill and solar panels, Urban problems related to energy, case studies

UNIT-III	**CLIMATIC CHANGE AND SOLID WASTE MANAGEMENT**	**9**

Environmental pollution- air, water, soil, marine and noise pollution- green house gases- causes, effects- global warming, ozone layer depletion, acid rain-sources and effects. Pollution control strategies, preventive measures, green technologies, green building concepts, standards and regulations, role of individuals, Sustainable development, Hazardous wastes, e-waste, source effect, management, Nuclear waste-sources, effects, management, Recycling of waste, Future challenges.

UNIT-IV	**HUMAN POPULATION AND THE ENVIRONMENT**	**9**

Population growth, variation among nations, population explosion, family welfare programme, environment and human health, human rights, value education, HIV / AIDS, women and child welfare, role of information technology in environment and human health, Case studies.

UNIT-V	**ENVIRONMENTAL LAW AND ETHICS**	**9**

Legal provision in India, environmental acts - air, water, forest, soil and wildlife. Environmental ethics, theories and codes, resource consumption patterns, equity-disparity, urban-rural equity issues, need for gender equity, preserving resource for future generation, right of animals, ethical basis of environment education and awareness, ethical problem solving- changing attitude, conservation ethics and traditional value systems of India, Effect of social media on the adolescent.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO 1	Interpret the concept of ecosystem, biodiversity and its conservation.
CO 2	Demonstrate the environmental impacts of energy development.
CO3	Categorize the various environmental pollutions and select suitable preventive measures.
CO4	Perceive the environmental effects of human population and the implementation of welfare programs.
CO 5	Recall the environmental ethics and legal provisions.

TEXT BOOKS

1. Erach Bharucha, "Text book for Environmental sciences for Undergraduate courses", UGC, 2004.
2. Kaushik, A &Kaushik, CP, Environmental Science and engineering", 3rd Edition, New Age International (P) Limited, New Delhi, 2009.
3. Henry, JG &Heinke, GW, "Environmental Science and Engineering", 2nd Edition, PHI Learning Private limited, New Delhi, 2011.

REFERENCES

1. Masters, GM &Ela, WP, "Introduction to Environmental Engineering and Science", 3rd Edition, PHI Learning Private limited, New Delhi, 2009.
2. Encyclopedia of environmental ethics and philosophy. Available at www.gmu.ac.ir/download/booklibrary/e-library/Encyclopaedia of Environmental Ethics and philosophy.pdf.

CO-PO&PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	-	2	1	1	-	-	-	2	-	-	-
CO2	3	2	2	-	-	2	1	1	-	-	-	2	-	-	-
CO3	3	2	1	-	-	2	1	1	-	-	-	2	-	-	-
CO4	3	2	1	-	-	2	1	1	-	-	-	2	-	-	-
CO5	3	2	2	-	-	2	1	1	-	-	-	2	-	-	-
CO	3	2	1	-	-	2	1	1	-	-	-	2	-	-	-

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE		191IT22A / INFORMATION TECHNOLOGY ESSENTIALS LABORATORY		0	0	2	1

COURSE OBJECTIVES
✓ To write simple scripts for the creation of web sites ✓ To create various information technology enabled applications.

LIST OF EXPERIMENTS	
1	Creation of interactive web sites - Design using HTML and authoring tools.
2	Creation of simple PHP scripts - Dynamism in web sites
3	Handling multimedia content in web sites
4	Database applications using PHP and MySQL
5	Study of computer networking components
6	Creation of information retrieval system using web, PHP and MySQL
7	Study of Technologies associated with mobile devices
8	Creation of Personal Information System
9	Basic commands of Networking.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Design interactive websites using basic HTML tags, different styles, links and with all.
CO2	Know about Basic control elements and To Create client side and server side programs using scripts& PHP.
CO3	Design web sites to handle multimedia components
CO4	Create applications with PHP connected to database.
CO5	Create Personal Information System and Implement the technologies behind and mobile communication.

CO-PO & PSO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	2	-	-	-	-	-	-	-	3	3	2
CO 2	3	3	2	2	2	2	-	-	-	2	-	1	2	3	2
CO 3	3	3	2	2	2	2	-	-	-	2	-	2	3	2	2
CO 4	3	3	2	2	2	2	-	-	-	2	-	2	3	3	2
CO 5	3	3	2	2	2	2	-	-	-	1	2	2	3	2	2
CO	3	3	2	2	2	2	-	-	-	2	2	2	3	3	2

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE		191EC21B / DIGITAL SYSTEM LABORATORY		0	0	2	1

COURSE OBJECTIVES

- ✓ Understand the various logic gates.
- ✓ Be familiar with various combinational circuits.
- ✓ Be exposed to sequential circuits.
- ✓ Learn to use HDL.

LIST OF EXPERIMENTS

1	Verification of truth tables of logic gates and theorems of Boolean algebra.
2	Design of half adder, full adder and parallel binary adder.
3	Design of BCD adder.
4	Design of 8 to 1 multiplexer and make use of it to implement a full adder.
5	Design of decimal to binary encoder.
6	Design of 2-bit magnitude converter.
7	Design of 4-bit ripple up and down counters.
8	Design of 4-bit shift register, ring counter and Johnson counter.
9	Simulation of a 4-bit parallel binary adder using HDL.
10	Simulation of a multiplexer and decoder using HDL.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Apply Boolean simplification techniques to construct combinational logic circuits
CO2	Build combinational logic circuits to perform arithmetic operations.
CO3	Implement combinational circuits using MSI devices.
CO4	Construct Sequential circuits like registers and counters.
CO5	Simulate combinational and sequential circuits using HDL.

CO-PO & PSO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	-	-	-	-	-	-	-	-	1	1	1	1
CO 2	3	3	3	-	-	-	-	-	-	-	-	1	1	1	1
CO 3	3	3	3	-	2	-	-	-	-	-	-	1	1	1	1
CO4	3	3	3	-	2	-	-	-	-	-	-	1	1	1	1
CO5	3	3	3	-	2	-	-	-	-	-	-	1	1	1	1
CO	3	3	3	-	2	-	-	-	-	-	-	1	1	1	1

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191CS21A / PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ 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, and dictionaries.
- ✓ Read and write data from/to files in Python.

LIST OF EXPERIMENTS

1	Compute the GCD of two numbers.
2	Find the square root of a number (Newton's method)
3	Exponentiation (power of a number)
4	Find the maximum of a list of numbers
5	Linear search and Binary search
6	Selection sort, Insertion sort
7	Merge sort
8	First n prime numbers
9	Multiply matrices
10	Programs that take command line arguments (word count)
11	Find the most frequent words in a text read from a file
12	Simulate elliptical orbits in Pygame
13	Simulate bouncing ball using Pygame.
14	Develop a mini project for Tic Tac Toe Game using Python .
	PLATFORM NEEDED
	Python 3 Interpreter for windows/ Linux

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Develop simple Python programs to test and debug.
CO2	Solve problems using conditionals and loops in Python.
CO3	Develop Python programs by defining functions.
CO4	Represent lists, Tuples and dictionaries for compound data.
CO5	Perform file operations using Python.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	1	-	-	-	1	-	-	-	3	2	2
CO2	3	3	2	2	2	-	-	-	1	-	-	2	3	2	2
CO3	3	3	2	2	2	-	-	-	1	-	-	2	3	2	2
CO4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
CO5	3	3	2	2	1	-	-	-	2	-	-	2	3	2	2
CO	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**3**	**2**	**2**

SEMESTER-III

YEAR	II		SEMESTER		III	L	T	P	C
COURSE CODE / COURSE TITLE	191HS301 / MAGAGEMENT SCIENCE					2	0	0	2

COURSE OBJECTIVES
☐ It makes the students aware of what is management
☐ Students learn how to overcome unexpected problems themselves
☐ It makes them active listeners by which they can be effective speakers
☐ Students become expertise in their written communication particularly
☐ It improves the academic standards and the employability skills

SYLLABUS	
UNIT-I **MANAGERIAL SKILLS**	**9**
Management introduction - Time Management - Stress Management- employability and career Skills-grooming as a professional with values - General awareness of Current Affairs.	
UNIT-II **LISTENING SKILLS**	**9**
Importance of listening -Active listening -Asking questions - Responding to the questions - Listen to the Audio - visual components -Listening Comprehension	
UNIT-III **SPEAKING SK1LLS**	**9**
General Conversation - Question and Answer sessions - Role play activities - Telephone skills- Public Speaking	
UNIT-IV **WRTTIGN SK1LLS**	**9**
Effective writing - Letter writing - E-mail writing - Paragraph writing - Report writing	
UNIT-V **PRESENTATION SKCLLS**	**9**
Introduction to Presenta1ion - Building up confidence -Effective Presentation - Body Language - Poster presentations - seminars relevant to Management	

	COURSE OUTCOMES
On completion of the course, students will be able to	
CO1	Overcome the stress in their respective field
CO2	Be an active listener so as to respond accurately and effectively
CO3	Raise and respond to the queries without any hesitation
CO4	Write effectively and to draft letters, E-mails impressively.
CO5	Deliver presentations confidently

TEXT BOOKS

1. The Quick & Easy Way to Effective Speaking by Dale Carnegie
2. The art of Public Speaking by Alex Mair
3. Art of Public Speaking by Utpal K Banerjee
4. Preparation Skills for the Upwardly Mobile by Roz Townsend

REFERENCES

1. Anderson, Williams,An introduction to management science 1976(Unit I)
2. Michael H.Hope, Active listening Improve your ability to listen and read 2002(Unit II)
3. David w.dugas,Ronald Des rosaiers,Speaking by speaking, 2004 (Unit III)
4. Judith F.olson, Writing skills Success in 20 Minutes a Day (Unit IV)
5. https://wiki.ubc.ca/presentation_skills(Unit V)

CO- PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO3	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO4	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO5	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-
CO	-	-	-	-	-	-	-	2	2	3	2	3	-	-	-

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191MA306 / DIFFERENTIAL CALCULUS**			2	2	0	3

COURSE OBJECTIVES

- ✓ The ability to apply the basic concepts of differential calculus and their applications in the field of Information Technology

SYLLABUS	
UNIT-I **LIMITS AND CONTINUITY**	**9**

Introduction to limit – properties – limit by direct substitution – algebraic manipulations – squeeze theorem – continuity at a point – continuity over a interval – removal of discontinuity – Intermediate value theorem (statement only) – problems.

UNIT-II **BASIC DIFFERENTIATION AND ITS RULES**	**9**

Average rate of Change – Derivative - basic definitions - Method of first principle – problems - Method of differentiation – sum – difference – product – quotient rule - problems

UNIT-III **ADVANCED DIFFERENTIATION**	**9**

Chain rule – Implicit differentiation – Inverse function differentiation – Logarithmic differentiation – Higher derivatives – Lebnitz theorem (statement only) - problems

UNIT-IV **APPLICATION OF DERIVATIVES**	**9**

Derivative : Slope – Tangent and Normal – problems - Related rates – Introduction – problems – Approximation – L' Hopital Rule – problems

UNIT-V **ANALYZING FUNCTIONS USING DIFFERENTIATION**	**9**

Mean value theorem – Extreme value theorem – Increasing and decreasing - Maxima and Minima – first and second derivative test – convexity and inflexion.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Compare and contrast the ideas of limits, continuity and differentiability.
CO2	Apply the basic concept of differentiation in their engineering fields.
CO3	Apply the basic differentiation rules to find derivatives of composite functions.
CO4	Explain the derivative as the slope of the tangent line to a function at a point and calculate limits in inderminate forms by a repeated use of L' Hospital rule.
CO5	Analyze the extremum and behaviour of functions.

TEXT BOOKS

1. R.K. Ghosh and K C Maity, "Introduction to Analysis, Differential Calculus Part - I",NCBA.
2. B.C. Das and B. N. Mukherjee, "Differential Calculus", Revised 52nd Edition, U. N. Dhur &SonsPrivate Ltd., Kolkata.

REFERENCES

1. Joseph Edwards, "Differential Calculus for Beginners', Macmillan and Co. Ltd., Newyork, 1896.

													CO-PO&PSOMapping		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**-**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE		191EC312 / ANALOG AND DIGITAL COMMUNICATION		3	0	0	3

COURSE OBJECTIVES

- ✓ To understand analog and digital communication techniques.
- ✓ To learn data and pulse communication.
- ✓ To be familiarize error coding techniques.
- ✓ To gain knowledge on multiuser communication.

SYLLABUS

UNIT-I	ANALOG MODULATION	9

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – Modulators and Demodulators – Superheterodyne receivers

UNIT-II	PULSE AND DATA COMMUNICATION	9

Sampling theorem – Quantization – PAM,PPM,PTM ,Pulse code modulation- DPCM, DM, and ADPCM And ADM, Frequency Division Multiplexing, Time Division Multiplexing, ,Data communication codes, Data communication circuits, Data communication Hardware -serial and parallel interfaces.

UNIT-III	DIGITAL MODULATION SCHEME	9

Amplitude shift keying, Frequency shift keying ,Phase shift keying – BPSK, DPSK, QPSK –M-ary PSK& QAM – Comparison of various digital schemes.

UNIT-IV	INFORMATION THEORY AND CODING	9

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Viterbi decoding.

UNIT-V	MULTIUSER RADIO COMMUNICATION	9

GSM,cellular concept, Frequency reuse, Channel assignment and Handover techniques, Overview ofmultiple access techniques– FDMA, TDMA, CDMA, Bluetooth.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Apply analog and digital communication techniques.
CO2	Describe pulse modulation techniques.
CO3	Analyze the various digital modulation techniques.
CO4	Evaluate information and coding techniques.
CO5	Identify concepts behind multiuser radio communication.

TEXT BOOKS
1. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill. 3 rd editionpearson education 2007. 2. Wayne Tomasi,'Advanced Electronic communication system,'6th Edition   Pearson Education 2009.

REFERENCES
1.Rapport T.S "Wireless Communication: Principles and practice", second edition Pearson Education2007. 2.J.G.Proakis, M.Salehi, ―Fundamentals of Communication Systems‖, Pearson Education 2014 3.Simon Haykin, ―Analog and digital communication, Wiley Publication, New Delhi, 2011.

CO-PO & PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	1	2	1	-	-	-	2	1	2	-	-	1
CO2	3	3	2	1	1	-	-	-	-	1	1	1	-	-	-
CO3	3	3	2	2	2	1	-	-	-	2	2	1	-	-	1
CO4	3	3	2	2	1	-	-	-	-	2	1	1	-	-	-
CO5	3	3	3	1	2	1	1	1	-	1	2	2	-	-	1
CO	**3**	**3**	**2**	**1**	**2**	**1**	**1**	**1**	**-**	**2**	**1**	**1**	**-**	**-**	**1**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191CS321 / DATA STRUCTURES			3	0	0	3

COURSE OBJECTIVES

- To learn the features of C
- To learn the linear and non-linear data structures
- To explore the applications of linear and non-linear data structures
- To learn to represent data using graph data structure
- To learn the basic sorting and searching algorithms

SYLLABUS

UNIT-I	C PROGRAMMING BASICS	9

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT-II	FUNCTIONS, POINTERS, STRUCTURES AND UNIONS	9

Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.

UNIT-III	LINEAR DATA STRUCTURES	9

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT-IV	NON-LINEAR DATA STRUCTURES	9

Trees – Binary Trees – Binary tree representation and traversals- Binary Search Trees -AVL Tree-B-Tree-B+ Tree –Applications of trees. Set representations – Union-Find operations. Graph and its representations – Graph Traversals.

UNIT-V	SEARCHING AND SORTING ALGORITHMS	9

Linear Search – Binary Search. Bubble Sort, Insertion sort – Merge sort – Quick sort –Selection Sort- Hash tables – Overflowhandling.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Find solutions for simple problems using basics of C programming language.
CO2	Apply the concepts of functions, pointers, structures and unions in practical applications.
CO3	Interpret linear data structure operations in C
CO4	Analyze and evaluate nonlinear data structure for the given application
CO5	Apply the hashing concepts an choose the appropriate sorting algorithm for an application

TEXT BOOKS
1.Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", John Wiley & Sons Inc., 2013 2.Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python"Springer Edition 2015

REFERENCES
1.Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley &Sons, 2011 2.Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983. 3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein,"Introduction to Algorithms", Second Edition, McGraw Hill, 2002. 4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", FourthEdition, Pearson Education, 2014

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	1	-	-	-	1	-	-	1	3	2	2
CO2	3	3	3	2	1	-	-	-	1	1	-	1	3	2	2
CO3	3	3	3	2		1	-	-	2	1	-	2	3	3	3
CO4	3	3	3	2	1	1	-	-	2	1	-	2	3	3	3
CO5	3	3	2	2	1	-	-	-	2	-	-	2	3	3	2
CO	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**2**	**1**	**-**	**2**	**3**	**3**	**2**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS322 / COMPUTER ARCHITECTURE**			2	2	0	3

COURSE OBJECTIVES

- ✓ To learn the basic structure and operations of a computer.
- ✓ To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- ✓ To learn the basics of pipelined execution.
- ✓ To understand parallelism and multi-core processors.
- ✓ To understand the memory hierarchies, cache memories and virtual memories.
- ✓ To learn the different ways of communication with I/O devices.

SYLLABUS

UNIT-I	BASIC STRUCTURE OF A COMPUTER SYSTEM	9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

UNIT-II	ARITHMETIC FOR COMPUTERS	9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism

UNIT-III	PROCESSOR AND CONTROL UNIT	9

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining –Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT-IV	PARALLELISM	9

Parallel processing challenges – Flynn's classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT-V	MEMORY & I/O SYSTEMS	9

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access- Bus structure – Bus operation – Arbitration – Interface circuits – USB - Associative Memory – Hardware Organization, Read and write operation.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Infer the basics concepts of fundamental component, architecture, register organization and performance metrics of a computer.
CO2	Analyze the efficient algorithms for performing binary arithmetic operations.
CO3	Analyze and Design various pipelined execution and design control unit.
CO4	Apply parallel processing concepts for efficient data processing.
CO5	Analyze the memory, I/O devices and cache structures for processor.

TEXT BOOKS

1 David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2 Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organizationand Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES

1. William Stallings, Computer Organization and Architecture – Designing for Performance, EighthEdition, Pearson Education, 2010.
2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012
3. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012

CO-PO & PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO3	3	3	2	1	-	-	-	-	-	-	-	3	3	2	3
CO4	3	2	2	1	-	-	-	-	2	1	-	2	3	2	2
CO5	3	3	2	1	-	-	-	-	1	1	-	3	3	2	3
CO	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**3**	**2**	**2**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS323 / OBJECT ORIENTED PROGRAMMING**			2	2	0	3

COURSE OBJECTIVES

- ✓ To understand Object Oriented Programming concepts and basic characteristics of Java
- ✓ To know the principles of packages, inheritance and interfaces
- ✓ To define exceptions and use I/O streams
- ✓ To develop a java application with threads and generics classes
- ✓ To design and build simple Graphical User Interfaces

SYLLABUS

UNIT-I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	10

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism-OOP in Java – Characteristics of Java – The Java Environment **-** Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

UNIT-II	INHERITANCE AND INTERFACES	9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists – Strings

UNIT-III	EXCEPTION HANDLING AND I/O	9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT-IV	MULTITHREADING AND GENERIC PROGRAMMING	8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, Thread priorities, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations

UNIT-V	EVENT DRIVEN PROGRAMMING	9

Applets: Basics, Applet class, Applet Architecture, Applet skeleton - Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists-choices- Scrollbars – Windows –Menus – Dialog Boxes-JDBC Connectivity.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Solve simple problems using basic oops concepts.
CO2	Identify the concept of inheritance, interfaces and illustrate the Java Programs.
CO3	Develop a applications using Exceptions and I/O streams
CO4	Analyze and evaluate the concept of threads and generic classes to develop Java applications
CO5	Create interactive Java programs using AWT and Swings

TEXT BOOKS
1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2011.   2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals‖, 9th Edition, PrenticeHall, 2013.

REFERENCES
1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers‖, 3rd Edition, Pearson, 2015.   2.Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2011.   3.Timothy Budd, ―Understanding Object-oriented programming with Java‖, Updated Edition,Pearson Education, 2000.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	-	-		-	1	-	-	-	1	3	2	2
CO2	3	3	3	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	2	2	-	-	1	-	-	-	2	3	3	2
CO4	3	3	3	-	2	-	-	-	-	-	-	2	3	2	2
CO5	3	3	3	3	2	-	-	1	1	1	-	2	3	3	2
CO	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**2**	3	3	2

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS32A / DATA STRUCTURES LABORATORY**			0	0	2	1

COURSE OBJECTIVES

- ✓ To understand and implement basic data structures using C
- ✓ To apply linear and non-linear data structures in problem solving.
- ✓ To learn to implement functions and recursive functions by means of data structures
- ✓ To implement searching and sorting algorithms

LIST OF EXPERIMENTS

1	Basic C Programs – looping, data manipulations, arrays
2	Programs using strings – string function implementation
3	Programs using structures and pointers
4	Programs involving dynamic memory allocations
5	Array implementation of stacks and queues
6	Linked list implementation of stacks and queues
7	Application of Stacks and Queues
8	Implementation of Trees, Tree Traversals
9	Implementation of Binary Search trees
10	Implementation of Linear search and binary search
11	Implementation Insertion sort, Bubble sort, Quick sort, Merge Sort and selection sort.
12	Implementation Hash functions, collision resolution technique
13	Implementation of AVL trees
14	Implementation of Minimum Spanning tree-Prim's Algorithm

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Develop the solutions for simple problems basic using C programming language.
CO2	Use functions, pointers, structures and unions for some practical applications.
CO3	Interpret and implement linear data structure operations in C
CO4	Create nonlinear data structure for the given application
CO5	Apply appropriate sorting & searching algorithm for an application

CO-PO &PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	1	-	-	-	-	-	-	1	3	2	1
CO2	3	3	3	2	1	-	-	-	1	-	-	1	3	3	2
CO3	3	3	3	2	2	1	-	-	-	-	-	2	3	3	2
CO4	3	3	3	2	2	1	-	-	1	-	1	2	3	3	2
CO5	3	3	3	2	2	1	-	-	1	-	1	2	3	3	2
CO	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**1**	**2**	**3**	**3**	**2**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE		**191CS32B /OBJECT ORIENTED PROGRAMMING LABORATORY**		**0**	**0**	**2**	**1**

COURSE OBJECTIVES
✓ To build software development skills using java programming for real world applications.   ✓ To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.   ✓ To develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1	1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.
	     If the type of the EB connection is domestic, calculate the amount to be paid as follows:
	     • First 100 units - Rs. 1 per unit
	     • 101-200 units - Rs. 2.50 per unit
	     • 201 -500 units - Rs. 4 per unit
	     • > 501 units - Rs. 6 per unit
	     If the type of the EB connection is commercial, calculate the amount to be paid as follows:
	     • First 100 units - Rs. 2 per unit
	     • 101-200 units - Rs. 4.50 per unit
	     • 201 -500 units - Rs. 6 per unit
	     • > 501 units - Rs. 7 per unit

2	Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages
3	Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4	Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

5	Write a program to perform string operations using ArrayList. Write functions for the following
	     a. Append – add at end
	     b. Insert – add at particular index
	     c. Search

	d. List all string starts with given letter
6	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7	Write a Java program to implement user defined exception handling.
8	Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the filein bytes.
9	Write a java program that implements a multi-threaded application that has three threads. Firstthread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print thevalue of cube of the number.
10	Write a java program to find the maximum value from the given type of elements using a generic function.

11	Design a calculator using event-driven programming paradigm of Java with the followingoptions.
	    a. Decimal manipulations
	    b. Scientific manipulations

12	Develop a mini project for any application using Java concepts.
13	Develop a Java Program using Applet

	COURSE OUTCOMES On completion of the course, students will be able to
CO1	Develop simple program using the procedural and object oriented paradigm with classes, functions,data and objects.
CO2	Analyze the concept of function overloading, operator overloading, virtual functions and polymorphism.
CO3	Implement Java programs for simple applications that make use of classes, packages and interfaces.
CO4	Develop and implement Java programs with array list, exception handling and multithreading.
CO5	Design applications using file processing, generic programming and event handling.

	CO-PO & PSO Mapping													
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	1	1	-	1	2	2	2	3	2	2
CO2	3	3	3	2	2	1	1	1	-	2	2	2	2	2	2
CO3	3	3	3	2	2	1	1	-	1	2	2	2	3	3	2
CO4	3	3	3	2	2	-	1	1	1	2	3	2	3	3	2
CO5	3	3	3	2	2	1	1	1	1	2	3	2	3	3	2
CO	3	3	3	2	2	1	1	1	1	2	2	2	3	3	2

Course Code	COURSE TITLE	L	T	P	C
191HS30B	**INTERPERSONAL SKILLS LABORATORY**	**0**	**0**	**2**	**1**

COURSE OBJECTIVES

- To equip students with the English language skills required for the successful undertaking of academicstudies with a primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

UNIT 1: Listening as a key skill- its importance- speaking - giving personal information - asking for personal information - expressing ability - enquire about ability - asking for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances. (6 Hours)

UNIT 2: Listen to process information- give information, as part of a simple explanation – conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics. (6 Hours)

UNIT 3: Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept – decline - take leave- listen for and follow the gist- listen for detail.(6 Hours)

UNIT 4: Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuading.   (6 Hours)

UNIT 5: Formal and informal talk - listen to follow and respond to explanations, directions, and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.   (6 Hours)

| | **TOTAL: 30 Hours** |

COURSE OUTCOMES:

On successful completion of this course, the students will be able to,

CO1	Listen and respond appropriately.
CO2	Converse in an efficient manner following accurate stress and intonation.
CO3	Participate in formal as well as informal conversations confidently.
CO4	Participate in group discussions
CO5	Make effective presentations

REFERENCES

1. Brooks, Margret. Skills for Success. Listening and speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010
3. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
4. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
6. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.

SEMESTER-IV

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191IT421/ SOFTWARE ENGINEERING AND DESIGN			3	0	0	3

COURSE OBJECTIVES
✓ To understand the concepts of process, product and project development.
✓ To elucidate the knowledge of requirement analysis.
✓ To provide the knowledge of software design.
✓ To understand the concepts of analysis modeling.
✓ To provide the knowledge of software testing.

SYLLABUS		
UNIT-I	FUNDAMENTALS OF SOFTWARE ENGINEERING	9
Software Engineering Fundamentals- Software processes: Software life-cycle and process models Process assessment models- Overview of Project Management activities		
UNIT-II	REQUIREMENTS ENGINEERING	9
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.		
UNIT-III	SOFTWARE DESIGN	9
Design Concepts & Principles - Design Process - Design Concepts - Modular Design - Design Effective Modularity - Introduction to Software Architecture - Data Design - Transform Mapping - Transaction Mapping - Object Oriented Design - System design process- Object design process - Design Patterns.		
UNIT-IV	ANALYSIS	9
Analysis Modeling - Data Modeling - Functional Modeling & Information Flow - Behavioral Modeling-Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model, Design modeling with UML.		
UNIT-V	IMPLEMENTATION, TESTING & MAINTENANCE	9
Top - Down, Bottom-Up, object oriented product Implementation & Integration. Software Testing methods-White Box, Basis Path-Control Structure - Black Box - Unit Testing - Integration testing - Validation & System testing - Testing Tools – Software Maintenance - Need for Maintenance -Types of Maintenance - Reengineering.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand and analyze the software development life cycle.
CO2	Identify different approaches adopted in gathering requirements.
CO3	Demonstrate the various software design concepts and understand different designs like architectural, structured, object oriented and user interface.
CO4	Model the event driven state of object and transform them into implementation specific layouts.
CO5	Apply software validation and testing for real time applications. Analyse software maintenance issues and challenges.

TEXT BOOKS
1. Roger. S. Pressman and Bruce R. Maxim, "Software Engineering – A Practitioner's Approach", seventh Edition, McGraw Hill, 2015.
2. Ian Sommerville, "Software Engineering", eighth edition, Pearson Education, New Delhi, 2011.
3. Bill Brykczynski, Richard D. Stutz ,"Software Engineering Project Management", Wiley India Edition, IEEE computer society, 2007.
4. Craig Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development (3rd Edition), Pearson Education, 2008.

REFERENCES
1. R. S. Pressman, Software Engineering- A Practitioner's Approach, Eighth Edition, Mc Graw Hill Higher Education, 2014.
2. K. V. K. K. Prasad, "Software Testing Tools", Dreamtech, 2004.
3. Fairley R, "Software Engineering Concepts", second edition, Tata McGraw Hill,New Delhi, 2003.
4. Jalote P, "An Integrated Approach to Software Engineering", third edition, Narosa Publishers, New Delhi, 2013.
5. Grady Booch, James Rumbaugh, Ivar Jacobson - "the Unified Modeling Language User Guide" - Addison Wesley, 1999.
6. Ali Bahrami, "Object Oriented Systems Development" 1st Edition, The McGraw-Hill Company, 1999

CO-PO & PSO Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	1	1	2	2	2	2	2	3	2	2
CO2	3	3	2	2	-	1	1	1	2	2	1	1	3	2	2
CO3	3	3	3	2	1	2	2	1	2	2	1	1	3	2	2
CO4	3	3	2	1	1	1	1	1	2	-	-	-	3	2	2
CO5	3	3	3	2	1	2	2	1	1	1	2	2	3	2	2
CO	3	3	2	2	1	1	1	1	2	2	2	2	3	2	2

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191MA403 / DISCRETE MATHEMATICS**			**2**	**2**	**0**	**3**

COURSE OBJECTIVES

- ✓ To extend student's logical and mathematical maturity and ability to deal with abstraction.
- ✓ To introduce most of the basic terminologies used in computer science courses andapplication of ideas to solve practical problems.
- ✓ To understand the basic concepts of combinatory and graph theory.
- ✓ To familiarize the applications of algebraic structures.
- ✓ To understand the concepts and significance of lattices and Boolean algebra.

SYLLABUS

UNIT-I	LOGIC AND PROOFS	9

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference.

UNIT-II	COMBINATORICS	9

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeon hole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT-III	GRAPHS	9

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT-IV	ALGEBRAIC STRUCTURES	9

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's –Normal subgroup and cosets – Lagrange's theorem

UNIT-V	LATTICES AND BOOLEAN ALGEBRA	9

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers and apply it in their fields.
CO2	Apply counting principles and estimate probabilities and also to analyze algorithms and programs by recurrence relation.
CO3	Analyze the different types of graphs and hence know about the application of graph theory in their field.
CO4	Analyze the algebraic structures and their application
CO5	Evaluate Boolean functions and simplify expression using the properties of Boolean algebra.

TEXT BOOKS

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw
Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to
Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition,
Pearson Education Asia, Delhi, 2007.

2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub.
Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006

CO-PO &PSO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-	**1**	**2**	-	-

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS421 / DESIGN AND ANALYSIS OF ALGORITHMS**			3	0	0	3

COURSE OBJECTIVES
✓ To understand and apply the algorithm analysis techniques. ✓ To critically analyze the efficiency of alternative algorithmic solutions for the same problem ✓ To understand different algorithm design techniques. ✓ To understand the limitations of Algorithmic power.

SYLLABUS		
UNIT-I	**INTRODUCTION**	**9**
Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms - Visualization		
UNIT-II	**BRUTE FORCE AND DIVIDE-AND-CONQUER**	**9**
Brute Force – Computing an – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers –Closest-Pair and Convex - Hull Problems.		
UNIT-III	**DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE**	**9**
Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem - Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees- Job sequencing problem.		
UNIT-IV	**ITERATIVE IMPROVEMENT**	**9**
The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stablemarriage Problem.		
UNIT-V	**COPING WITH THE LIMITATIONS OF ALGORITHM POWER**	**9**
Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.		

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Identify the fundamental needs of algorithms in problem solving and methods for evaluating the time and space complexity.
CO2	Identify the solution for problems using Brute-Force & Divide-and- Conquer and analyze its efficiency.
CO3	Apply Greedy and Dynamic programming technique to find solutions for complex problems and analyze its efficiency.
CO4	Solve the problems using iterative methods and analyze its efficiency.
CO5	Finding the solutions for the different problems using Backtracking and Branch & Bound algorithm and analyze its efficiency.

TEXT BOOKS
1. Anany Levitin, ―Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, SecondEdition, Universities Press, 2007.

REFERENCES
1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms‖,Pearson Education, Reprint 2006.
3. Harsh Bhasin, ―Algorithms Design and Analysis, Oxford university press, 2015.
4. http://nptel.ac.in/

CO-PO &PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2	-	-	-	-	-	-	-	-	2	3	1	1
CO2	3	3	2	2	-	-	-	-	2	2	-	2	3	2	2
CO3	3	3	2	2	-	-	-	-	1	1	-	2	3	2	2
CO4	3	3	2	2	-	-	-	-	1	1	-	2	3	2	2
CO5	3	3	2	2	-	-	-	-	1	1	-	2	3	2	1
CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**3**	**2**	**2**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191CS422 / DATA BASE MANAGEMENT SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn the fundamentals of data models and to represent a database system using ER diagrams.
- ✓ To study SQL and relational database design.
- ✓ To understand the internal storage structures using different file and indexing techniques whichwill help in physical DB design.
- ✓ To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- ✓ To have an introductory knowledge about the Storage and Query processing Techniques

SYLLABUS

UNIT-I	RELATIONAL DATABASES	9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals
– Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT-II	DATABASE DESIGN	9

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT-III	TRANSACTIONS	9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT-IV	IMPLEMENTATION TECHNIQUES	9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices –B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

UNIT-V	ADVANCED TOPICS	9

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems-Industrial application of DBMS – Education – Manufacturing-Telecom.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Apply queries for manipulation of data.
CO2	Design ER diagram and normalization for complex problem.
CO3	Implement the transaction processing, concurrency control techniques and recovery procedures.
CO4	Compare and contrast various indexing strategies and query processing and optimization in different database systems.
CO5	Develop database application using modern technique.

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts, SixthEdition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems, Sixth Edition,Pearson Education, 2011.

REFERENCES

1. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition,Pearson Education, 2006.
2. Raghu Ramakrishnan, ―Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,"Database Management Systems, Tata McGraw Hill, 2011.

CO-PO &PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	1	-	-	-	1	1	-	2	2	2	2
CO2	3	3	3	2	1	-	-	-	2	1	-	2	3	3	3
CO3	3	3	2	2	1	-	-	-	2	1	-	1	3	3	2
CO4	3	3	3	2	2	-	-	-	1	1	-	2	3	3	2
CO5	3	3	3	2	2	-	-	-	2	2	-	3	3	3	3
CO	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**3**	**3**	**2**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191CS423 /	OPERATING SYSTEMS		3	0	0	3

COURSE OBJECTIVES

 To understand the basic concepts and functions of operating systems.

 Understand the structure and functions of OS.

 Learn about Processes, Threads and Scheduling algorithms.

  Understand the principles of concurrency and Deadlocks.

 To analyze various memory management schemes.

 To understand I/O management and File systems.

 To be familiar with the basics of Linux system and Mobile OS like iOS and Android

SYLLABUS

UNIT-I	PROCESSES AND THREADS	9

Operating system overview-objectives and functions, Evolution of Operating System -operating system structures – system calls – system programs – system structure – virtual machines. Processes: Process concept – Process scheduling – Operations on processes –Cooperating processes – Interprocess communication – Communication in client-server systems-Threads: Multi-threading models – Threading issues.

UNIT-II	PROCESS SCHEDULING AND SYNCHRONIZATION	9

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Algorithm Evaluation- Process Synchronization: The critical-section problem –Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization –Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance –Deadlock detection – Recovery from deadlock, Distributed Operating System concepts, Real time OS, Mobile OS

UNIT-III	STORAGE 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-IV	FILE SYSTEMS AND I/O SYSTEMS	9

Mass-Storage Structure: Disk scheduling – Disk management –Swap-space management-File-System Interface: File concept – Access methods – Directory structure – File system mounting – Protection. File-System Implementation: Directory implementation –Allocation methods – Free-space management – efficiency and performance – recovery. I/O Systems– I/O Hardware – Application I/O interface – kernel I/O subsystem – streams – performance

UNIT-V	CASE STUDY	9

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System, Future directions in Mobile OS.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Create new Process and apply the basic OS concepts.
CO2	Compare various scheduling algorithms and Understand deadlock prevention and avoidance algorithms.
CO3	Design and implement memory management schemes
CO4	Analyze the functionality of file systems
CO5	Review the administrative tasks on Linux Servers and to Compare iOS and Android Operating Systems

TEXT BOOKS
1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9thEdition, John Wiley and Sons Inc., 2012

REFERENCES
1. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.   2. Andrew S. Tanenbaum, ―Modern Operating Systems, Second Edition, Pearson Education, 2004..   3. Achyut S.Godbole, Atul Kahate, ―Operating Systems, McGraw Hill Education, 2016.   4 Gary Nutt, ―Operating Systems‖, Third Edition, Pearson Education, 2004.   5. Daniel P Bovet and Marco Cesati, ―Understanding the Linux kernel, 3rd edition, O'Reilly, 2005   6. http://nptel.ac.in/.   7. Neil Smyth, ―iPhone iOS 4 Development Essentials – Xcode, Fourth Edition, Payload media, 2011

CO-PO & PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	1	1	-	1	-	1	1	-	1	2	2	1
CO2	3	3	2	2	1	-	1	-	1	1	-	1	3	3	2
CO3	3	3	2	2	1	-	1	-	1	1	-	1	3	3	2
CO4	3	3	2	2	1	-	1	-	1	1	-	1	3	2	2
CO5	3	2	2	2	1	-	1	-	1	1	-	2	2	2	1
CO	**3**	**3**	**2**	**2**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**3**	**2**	**2**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE		**191CS42A/ DATABASE MANAGEMENT SYSTEMS LABORATORY**		0	0	2	1

COURSE OBJECTIVES
✓ To understand data definitions and data manipulation commands   ✓ To learn the use of nested and join queries   ✓ To understand functions, procedures and procedural extensions of data bases   ✓ To be familiar with the use of a front end tool   ✓ To understand design and implementation of typical database applications

LIST OF EXPERIMENTS	
1	Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2	Database Querying – Simple queries, Nested queries, Sub queries and Joins
3	Draw ER Diagram and convert entities and relationships to relation table for a given scenario i)Bank ii)College
4	Views, Sequences, Synonyms
5	Database Programming: Implicit and Explicit Cursors
6	Procedures and Functions
7	Triggers
8	Exception Handling
9	Database Design using ER modeling, normalization and Implementation for any application
10	Database Connectivity with Front End Tools
11	Case Study on real life database applications

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Apply data definitions and manipulation commands to simple problems.
CO2	Use nested and join query for real time application.
CO3	Apply simple applications that use Views.
CO4	Analyze applications that require a Front-end Tool.
CO5	Evaluate and analyze the use of Tables, Views, Functions and Procedures.

CO-PO & PSO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	1	2	-	-	-	-	-	1	2	3	3	-
CO 2	3	2	2	1	2	-	-	-	-	-	1	3	3	3	1
CO 3	3	3	2	2	2	-	-	-	-	-	1	3	3	3	2
CO 4	3	3	2	2	2	-	-	-	2	1	1	3	3	3	2
CO 5	3	3	2	2	2	-	-	-	2	1	1	3	3	3	2
CO	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**1**	**1**	**3**	**3**	**3**	**2**

YEAR		II	SEMESTER		IV	L	T	P	C
COURSE CODE / COURSE TITLE		**191CS42B/ OPERATING SYSTEMS LABORATORY**				**0**	**0**	**2**	**1**

COURSE OBJECTIVES
✓ To learn Unix commands and shell programming   ✓ To implement various CPU Scheduling Algorithms   ✓ To implement Process Creation and Inter Process Communication.   ✓ To implement Deadlock Avoidance and Deadlock Detection Algorithms   ✓ To implement Page Replacement Algorithms   ✓ To implement File Organization and File Allocation Strategies

LIST OF EXPERIMENTS	
1	Basics of UNIX commands
2	Write programs using the following system calls of UNIX operating system fork, exec,getpid, exit, wait, close, stat, opendir, readdir
3	Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4	Shell Programming
5	Write C programs to implement the various CPU Scheduling Algorithms
6	Implementation of Semaphores
7	Implementation of Shared memory and IPC
8	Bankers Algorithm for Deadlock Avoidance
9	Implementation of Deadlock Detection Algorithm
10	Write C program to implement Threading & Synchronization Applications
11	Implementation of the following Memory Allocation Methods for fixed partition a) First Fit b) Worst Fit c) Best Fit
12	Implementation of Paging Technique of Memory Management
13	Implementation of the following Page Replacement Algorithms a) FIFO b) LRU c) LFU
14	Implementation of the various File Organization Techniques
15	Implementation of the following File Allocation Strategies a) Sequential b) Indexed c) Linked
16	Case Study on Android OS/IoS Family
17	Case Study on VMware Workstation

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Analyze the performance of various CPU Scheduling Algorithms.
CO2	Implement Deadlock avoidance and Detection Algorithms.
CO3	Implement Semaphores.
CO4	Create processes and implement IPC.
CO5	Analyze the performance of the various Page Replacement Algorithms and Implement File Organization and File Allocation Strategies

CO-PO & PSO Mapping																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	1	-	-	-	-	-	-	1	3	3	3
CO2	3	3	3	2	2	-	-	-	2	-	-	1	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
CO4	3	3	3	3	2	-	-	-	1	-	-	2	3	2	2
CO5	3	3	3	3	2	2	2	2	2	1	2	2	3	3	3
CO	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**3**	**3**	**2**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE		191HS40C / PROFESSIONAL COMMUNICATION		0	0	2	1

COURSE OBJECTIVES:
The course aims to:
• Enhance the Employability and Career Skills of students
• Orient the students towards grooming as a professional
• Make them Employable Graduates
• Develop their confidence and help them attend interviews successfully.

SYLLABUS
UNIT I **(6 Hours)**
Introduction to Soft Skills– Hard skills & soft skills – employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs
UNIT II **(6 Hours)**
Self-Introduction-organizing the material – Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations
UNIT III **(6 Hours)**
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics – brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills
UNIT IV **(6 Hours)**
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews
UNIT V **(6 Hours)**
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career change
TOTAL : 30 PERIODS

COURSE OUTCOMES	
At the end of the course Learners will be able to:	
CO1	Develop hard skills, soft skills and career skills for grooming as a professional.
CO2	Make effective presentations
CO3	Participate confidently in Group Discussions
CO4	Attend job interviews and be successful in them.
CO5	Develop adequate Soft Skills required for the workplace

TEXTBOOK
Recommended Software 1. Globearena 2. Win English
REFERENCES:
1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

SEMESTER-V

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		**191MA502/ PROBABILITY AND STATISTICS**		3	0	0	3

COURSE OBJECTIVES
✓ Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.   ✓ Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation

SYLLABUS		
UNIT-I	**PROBABILITY AND RANDOM VARIABLES**	**9**
Probability -Axioms of probability – Conditional probability – Baye's theorem - Random variable - Probability mass function - Probability density function - Cumulative distribution function - Moments - Moment generating functions.		
UNIT-II	**STANDARD DISTRIBUTIONS**	**9**
Discrete distributions - Binomial, Poisson, Geometric distributions - Continuous distributions- Uniform-Exponential, and Normal distributions		
UNIT-III	**TWO DIMENSIONAL RANDOM VARIABLES**	**9**
Random variables-One and two dimensional random variables-Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression.		
UNIT-IV	**TESTING OF HYPOTHESIS**	**9**
Sampling distributions- Large sample test: Tests for mean- Small sample tests: Tests for mean (t test),F- test- Chi-square test for Goodness of fit and Independence of attributes		
UNIT-V	**DESIGN OF EXPERIMENTS**	**9**
Analysis of Variance - One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.		

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Demonstrate and apply the basic probability axioms and concepts in their core areas.
CO2	Apply the concepts of probability distributions in an appropriate place of science and Engineering.
CO3	Calculate the relationship of two dimensional random variables using correlation techniques and to study the properties of two dimensional random variables.
CO4	Apply the concept of testing of hypothesis for small and large samples in real life problems..
CO5	Identify the classification of design of experiment in their respective fields.

TEXT BOOKS

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002.

REFERENCES

1. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt.Ltd., Bangalore, 2012.
2. Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition,Pearson Education, Asia, 2002.
3. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 2004.
4. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.

CO-PO&PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	2	-	-
CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**-**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191EC511 / MICROPROCESSORS AND MICROCONTROLLERS		3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the Architecture of 8086 Microprocessor and 8051Microcontroller
- ✓ To interface 8086 Microprocessor and 8051 Microcontroller with supporting chips.
- ✓ To design a microcontroller based system.

SYLLABUS

UNIT-I	THE 8086 MICROPROCESSOR	9

Overview of Microprocessors, 8086 – Architecture ,Signals, Addressing modes , Instruction set and assembler directives ,Assembly language programming , Stacks , Procedures ,Macros , Interrupts and interrupt service routines , Introduction to advanced microprocessors.

UNIT-II	PERIPHERAL INTERFACING AND PROGRAMMING	9

Parallel communication interface, Serial communication interface, D/A and A/D Interface, Timer, Keyboard /display controller , DMA controller, Traffic Light control Interfacing Techniques

UNIT-III	8051 MICROCONTROLLER	9

Functional block diagram and pin diagram of 8051-Special Function register-Program and Data Memory organization-addressing modes. Instruction Set: data transfer, arithmetic and logical, program branching instructions and Boolean variable manipulation

UNIT-IV	ON-CHIP PERIPHERALS AND PROGRAMMING TECHNIQUES	9

Input output pins, ports and circuits, timer/counter-Operating Modes-Programming 8051 Timers - Counter Programming-Serial Communication: Basics of Serial Communication Modes-Serial Port Programming. Interrupt: 8051 Interrupt- External and Internal Interrupts- Programming timer Interrupts, external hardware interrupts and serial communication interrupts -Interrupt Priority and Programming.

UNIT-V	PERIPHERAL INTERFACING AND PROGRAMMING	9

D/A and A/D Interface, LED interfacing, LCD interfacing, Keyboard /display Interface, Sensor Interfacing, and Stepper Motor Interfacing Techniques, Comparison of 8051, PIC, ARM.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyze and implement programs on 8086 microprocessor.
CO2	Interface the peripherals and I/O devices with 8086 microprocessor.
CO3	Interpret 8051 microcontrollers' architectures and its functionalities.
CO4	Design and development of 8051 microcontroller based systems for real time applications
CO5	Interface the peripherals and I/O devices using 8051 microcontroller.

TEXT BOOKS
1. Muhammad Ali Mazidi, J.G. Mazidi, R.D. McKinlay,"The 8051 Microcontroller and Embedded Systems", Second Edition, Prentice Hall of India Pvt. Ltd., 2007.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012.

REFERENCES
1. Krishna Kant, "Microprocessors and Microcontrollers- Architecture, programming and systemdesign 8085, 8086, 8051,8096", Prentice Hall of India, New Delhi, 2007.
2. Kenneth J Ayala, "The 8051 Microcontroller – Architecture, Programming and Applications",Penram International Publications, Mumbai India, 1996.
3. Doughlas V.Hall,"Microprocessors and Interfacing, Programming and Hardware", TMH, 2012

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	1	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	3	2	1	1	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	1	-	-	-	1	1	2	2	3	3	3
CO	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**3**	**2**	**2**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	**191HS501** / **TOTAL QUALITY MANAGEMENT**			3	0	0	3

COURSE OBJECTIVES

✓ To facilitate the understanding of Quality Management principles and process.

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention -Costs of quality.

UNIT-II	TQM PRINCIPLES	9

Leadership - Strategic quality planning, Quality Councils - Employee involvement -Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT-III	TQM TOOLS AND TECHNIQUES I	9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT-IV	TQM TOOLS AND TECHNIQUES II	9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs – Performance measures.

UNIT-V	QUALITY SYSTEMS	9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits – TQM Implementation in manufacturing and service sectors.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Describe and evaluate the basic concepts of quality management.
CO2	Apply motivation parameter to build the continuous quality process management.
CO3	Prepare the applications of quality tools and techniques in both manufacturing and service industry.
CO4	Develop analytical skills for investigating and analyzing quality management issues in management sectors.
CO5	Analyze the various quality systems in manufacturing and service sector.

TEXT BOOKS
Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES
James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	-	-	-	-	1	1	3	3	2	1	-	-	-
CO2	-	-	-	-	-	-	3	3	3	3	2	-	-	-	-
CO3	-	-	-	-	-	-	2	2	3	1	1	-	-	-	-
CO4	-	-	-	-	-	-	2	2	3	2	1	-	-	-	-
CO5	-	-	-	-	-	-	2	2	2	3	3	-	-	-	2
CO	-	-	-	-	-	-	2	2	3	3	3	1	-	-	2

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191IT521 / COMPUTER NETWORKS		3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the division of network functionalities into layers.
- ✓ To be familiar with the components required to build different types of networks.
- ✓ To be exposed to the required functionality at each layer.
- ✓ To Learn the flow control and congestion control algorithms.

SYLLABUS

UNIT-I	FUNDAMENTALS AND LINK LAYER	9

Building a network, Requirements, Layering and protocols, Internet Architecture, Network software, Performance; Link layer Services, Framing, Error Detection, and Flow Control.

UNIT-II	MEDIA ACCESS AND INTERNETWORKING	9

Media Access Control –Ethernet (802.3), Wireless LANs, 802.11, Bluetooth, Switching and bridging, Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP).

UNIT-III	ROUTING	9

ROUTING (RIP, OSPF, Metrics), Switch basics, Global Internet (Areas, BGP, IPv6), Multicast, addresses, Multicast Routing (DVMRP, PIM).

UNIT-IV	TRANSPORT LAYER	9

Introduction –Transport Layer Protocols –Services –Port Numbers –User Datagram Protocol –Transmission Control Protocol –SCTP.

UNIT-V	APPLICATION LAYER & SDN	9

WWW and HTTP –FTP –Email –Telnet –SSH –DNS –SNMP.
Software Defined Networking-Why SDN – Evolution of SDN –Architecture and working of SDN

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Identify the basic layers and its functions of computer networks
CO2	Analyze the data flows from one node to another.
CO3	Analyze and design routing algorithms.
CO4	Understand the services offered by transport layer protocols for various functions in the network.
CO5	Analyze the working principles of various application layer protocols.

TEXT BOOKS

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A System Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. Belhrouz A. Forouzan, "Data Communications and Networking", Fifth Edition TMH, 2013.

REFERENCES

1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communications Networks", Pearson Prentice Hall Publishers, 2010.
3. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.
4. Ying -Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
5. Behrouz A. Forouzan, "Data Communication and Networking", Fourth Edition, Tata McGraw Hill, 2011.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	-	-	-	-	2	-	1	-	3	1	1
CO2	3	3	1	1	1	-	-	-	2	1	2	1	3	2	1
CO3	3	3	2	2	1	2	-	-	-	-	1	1	3	2	2
CO4	3	3	2	2	1	2	-	2	2	2	1	1	3	2	2
CO5	3	3	3	2	-	-	-	2	2	1	2	1	3	3	2
CO	3	3	2	2	1	2	-	2	2	1	1	1	3	2	2

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191IT522/WEB TECHNOLOGY		3	0	0	3

COURSE OBJECTIVES

- ✓ To understand about client-server communication and protocols used during communication
- ✓ To design interactive web pages using Scripting languages
- ✓ To learn server side programming using servlets and JSP.
- ✓ To develop web pages using XML/XSLT.

SYLLABUS

UNIT-I	WEB SITE BASICS AND HTML	9

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

UNIT-II	CSS AND CLIENT SIDE SCRIPTING	9

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML-Style Rule Cascading and Inheritance-Text Properties-Box Model Normal FlowBox Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

UNIT-III	SERVER SIDE SCRIPTING	9

Server-Side Programming: Java Servlets-Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle-Parameter Data-Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency-Databases and Java Servlets.

UNIT-IV	JSP AND XML	9

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm-Databases and JSP. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT-V	WEB SERVICES	9

Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL-Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies. AngularJS: Core concepts, Application Structure, other features-.UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation.
.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Design simple web pages using markup languages like HTML and XHTML.
CO2	Create dynamic web pages using DHTML and java script that is easy to navigate and use.
CO3	Develop server side web pages that have to process request from client side web pages.
CO4	Represent web data using XML and develop web pages using JSP.
CO5	Analyse various web services and their interaction with other web services.

TEXT BOOKS
1. Jeffrey C. Jackson, "Web Technologies-A Computer Science Perspective", Pearson Education, 2017.

REFERENCES
1.Navneet Mehra, Bunny Mehra, Website Development Using HTML and CSS ,2012. 2.Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition,PearsonEducation, 2007. 3.Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006. 4.Uttam k Roy, "Web Technologies", Oxford Education, 2010.

CO-PO & PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	-	1	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	-	1	-	-	-	2	-	-	2	3	3	2
CO3	3	3	3	2	1	-	-	-	2	-	-	2	3	3	2
CO4	3	3	3	2	1	-	-	-	2	2	-	2	3	2	2
CO5	3	3	3	2	1	-	-	-	-	2	-	2	3	3	2
CO	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**3**	**3**	**2**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191IT52A /WEB TECHNOLOGY LABORATORY		0	0	2	1

COURSE OBJECTIVES

- ✓ To design web pages using Scripting languages.
- ✓ To learn server side programming using servlets and JSP.
- ✓ To develop web pages using XML/XSLT.

LIST OF EXPERIMENTS

1	Create a web page with the following using HTML i) To embed an image map in a web page. ii) To fix the hot spots. iii) Show all the related information when the hot spots are clicked
2	Create a web page with all types of Cascading style sheets.
3	Client Side Scripts for Validating Web Form Controls using DHTML.
4	Installation of Apache Tomcat web server.

5	Write programs in Java using Servlets:
	     a. To invoke servlets from HTML forms.
	
	     b. Session Tracking.

6	Write programs in Java to create three-tier applications using JSP and Databases
	     a. For conducting on-line examination.
	
	     b. For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.

7	Programs using XML –Schema –XSLT/XSL.
8	Programs using DOM and SAX parsers.
9	Programs using Angular JS.
10	Consider a case where we have two web Services-an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.
11	Implementation of UDDI using Web Services.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Design web pages using markup languages like HTML and XHTML.
CO2	Create dynamic web pages using DHTML and java script.
CO3	Implementation of client side web pages and server side web pages.
CO4	Represent web data using XML and develop web pages using JSP.
CO5	Implement various web services and their communication with other web services.

									CO-PO & PSO Mapping							
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	1	-	2	2	1	-	2	3	3	2
CO2	3	3	3	2	2	1	-	2	2	1	-	2	3	3	2
CO3	3	3	3	2	2	1	-	2	2	1	-	2	3	3	2
CO4	3	3	3	2	2	1	-	2	2	1	-	2	3	3	2
CO5	3	3	3	2	2	1	-	2	2	1	-	2	3	3	2
CO	3	3	3	2	2	1	-	2	2	1	-	2	3	3	2

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191IT52B / NETWORKS LABORATORY			0	0	2	1

COURSE OBJECTIVES
✓ To learn socket programming. ✓ To implement and analyze various network protocols. ✓ To learn and use simulation tools. ✓ To use simulation tools to analyze the performance of various network protocols.

LIST OF EXPERIMENTS	
1	Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2	Write a HTTP web client program to download a web page using TCP sockets.

3	Applications using TCP sockets like:
	    a. Echo client and echo server
	    b. Chat
	    c. File Transfer

4	Simulation of DNS using UDP sockets.
5	Write a code simulating ARP /RARP protocols.
6	Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7	Study of TCP/UDP performance using Simulation tool.
8	Simulation of Distance Vector/ Link State Routing algorithm.
9	Performance evaluation of Routing protocols using Simulation tool.
10	Simulation of error correction code (like CRC).
11	Implement Wireless Sensor Network.
12	Simulate Mobile Adhoc Network

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Implement Applications using TCP sockets.
CO2	Analyse the performance of TCP and UDP using simulation tools.
CO3	Use simulation tools to measure the performance of various network protocols.
CO4	Analyze various routing algorithms.
CO5	Develop error correction codes.

CO-PO & PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	2	2	1	1	-	1	1	1	-	3	3	2
CO2	3	3	3	3	2	2	2	-	1	1	1	-	3	3	2
CO3	3	3	3	3	3	2	1	-	2	2	1	2	3	3	2
CO4	3	3	3	3	3	2	2	-	2	2	1	2	3	3	2
CO5	3	3	3	3	3	1	2	-	1	1	1	2	3	3	2
CO	**3**	**3**	**3**	**3**	**3**	**2**	**2**	-	**1**	**1**	**1**	**2**	**3**	**3**	**2**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	**191EC51A / MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**			0	0	2	1

COURSE OBJECTIVES
✓ To Introduce ALP concepts, features and Coding methods   ✓ Write ALP for arithmetic and logical operations in 8086 and8051   ✓ Differentiate Serial and Parallel Interface   ✓ Interface different I/Os with Microprocessors   ✓ Be familiar with MASM

LIST OF EXPERIMENTS	
1	Basic arithmetic and Logical operations
2	Move a data block without overlap
3	Code conversion, decimal arithmetic and Matrix operations
4	Floating point operations, string manipulations, sorting and searching
5	Password checking, Print RAM size and system date
6	Counters and Time Delay Peripherals and Interfacing Experiments
7	Traffic light controller
8	Stepper motor control
9	Digital clock
10	Key board and Display
11	Serial interface and Parallel interface
12	A/D and D/A interface and Waveform Generation8051 Experiments using kits and MASM
13	Basic arithmetic and Logical operations
14	Square and Cube program, Find 2's complement of a number
15	Unpacked BCD to ASCII

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Write ALP Programmes for fixed and Floating Point and Arithmetic operations
CO2	Interface different I/Os with processor
CO3	Generate waveforms using Microprocessors
CO4	Execute Programs in 8051.
CO5	Analyze the working of simulator and Emulator.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CO1	3	3	2	2	2			-	1	1	1	2	3	2	2
CO2	3	3	2	2	2			-	1	1	1	2	3	2	2
CO3	3	3	2	2	2			-	1	1	1	2	3	2	2
CO4	3	3	2	2	2			-	1	1	1	2	3	2	2
CO5	3	3	2	2	2			-	1	1	1	2	3	2	2
CO	**3**	**3**	**2**	**2**	**2**			**-**	**1**	**1**	**1**	**2**	**3**	**2**	**2**

SEMESTER-VI

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191IT621/ ARTIFICIAL INTELLIGENCE		3	0	0	3

COURSE OBJECTIVES

- Identify problems that are able to solution by AI methods.
- Recognize appropriate AI methods to solve a given problem.
- Represent the knowledge using NLP.
- Assess critically the techniques presented and apply them to real world problems

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction- Definition - Future of Artificial Intelligence –-Characteristics of Intelligent Agents–-Typical Intelligent Agents -– Problem Solving Approach to Typical AI problems –Data Science and Business Analytics.

UNIT-II	PROBLEM SOLVING METHODS	12

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	8

First Order Predicate Logic -– Prolog Programming -– Unification -– A –- Resolution -– Knowledge Representation –- Ontological Engineering-Categories and Objects- – Events – -Mental Events and Mental Objects- – Reasoning Systems for Categories -–Reasoning with Default Information-Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models

UNIT-IV	SOFTWARE AGENTS AND EXPERT SYSTEMS	8

Architecture for Intelligent Agents -– Agent communication –- Negotiation and Bargaining – Argumentation among Agents -– Trust and Reputation in Multi-agent systems-Expert system shells-Typical expert system-MYCIN,DART

UNIT-V	APPLICATIONS	8

AI applications -– Language Models -– Information Retrieval- Information Extraction – Natural Language Processing -– Machine Translation –- Speech Recognition- – Robot – Hardware –-Perception --Planning – Moving- AI applications in health care, Education and Agriculture.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Gain knowledge on software agents in business analytics.
CO2	Apply appropriate search algorithms for any AI problem
CO3	Represent a problem using first order and predicate logic
CO4	Design software agents to solve a problem
CO5	Develop applications using NLP & Artificial Intelligence.

TEXT BOOKS
1 S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, ThirdEdition, 2009. 2 I. Bratko, ―Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-WesleyEducational Publishers Inc., 2011.

REFERENCES
1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science), Jonesand Bartlett Publishers, Inc.; First Edition, 2008 2. Nils J. Nilsson, ―The Quest for Artificial Intelligence, Cambridge University Press,2009. 3. William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISOStandard, Fifth Edition, Springer, 2003. 4. Gerhard Weiss, ―Multi Agent Systems, Second Edition, MIT Press, 2013. 5. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations ofComputational Agents, Cambridge University Press, 2012.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	3	2	1	-	-	-	2	-	-	2	3	2	2
CO3	3	3	3	2	1	1	-	-	1	-	-	2	3	2	2
CO4	3	3	3	2	-	1	-	-	2	-	-	2	3	2	2
CO5	3	3	3	2	-	1	-	-	2	-	-	2	3	2	2
CO	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**2**	**-**	**-**	**2**	**3**	**2**	**2**

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191IT622 / CLOUD COMPUTING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the concept of cloud computing.
- ✓ To appreciate the evolution of cloud from the existing technologies.
- ✓ 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.

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT-II	CLOUD ENABLING TECHNOLOGIES	9

Service Oriented Architecture – REST and Systems of Systems – Web Services – PublishSubscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels ofVirtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT-III	CLOUD ARCHITECTURE, SERVICES AND STORAGE	9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public,Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT-IV	RESOURCE MANAGEMENT AND SECURITY IN CLOUD	9

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM –Security Standards- Cloud migration and data privacy.

UNIT-V	CLOUD TECHNOLOGIES AND ADVANCEMENTS	8

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation –Federated Services and Applications – Future of Federation- Automated cloud orchestration.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
CO2	Understand the key enabling technologies that help in the development of cloud.
CO3	Make use of NIST cloud computing architecture to solve architecture design challenges.
CO4	Explore the core issues of cloud computing such as resource management and security.
CO5	Review the emergence of cloud as the next generation computing paradigm.

TEXT BOOKS

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, FromParallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing:implementation,anagement 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.

CO-PO & PSO Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	-	-	-	-	-	-	-	3	2	2
CO2	3	2	2	2	1	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	1	1	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	1	2	-	1	-	-	-	2	3	2	2
CO5	3	3	3	2	2	1	1	-	-	-	-	2	3	3	3
CO	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**2**	**3**	**2**	**2**

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT623 / INTERNET OF THINGS**			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the fundamentals of Internet of Things
- ✓ To learn about the basics of IOT protocols
- ✓ To build a small low cost embedded system using Raspberry Pi.
- ✓ To apply the concept of Internet of Things in the real world scenario.

SYLLABUS

UNIT-I	INTRODUCTION TO IoT	9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT-II	IoT ARCHITECTURE	9

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT-III	IoT PROTOCOLS	9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

UNIT-IV	BUILDING IoT WITH RASPBERRY PI & ARDUINO	9

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - LED lighting using Raspberry Pi kit- Linux on Raspberry Pi - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT-V	CASE STUDIES AND REAL-WORLD APPLICATIONS	9

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs – Cloud for IoT -IBM web services- Amazon Web Services for IoT.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyze various protocols for IoT
CO2	Develop web services to access/control IoT devices.
CO3	Design a portable IoT using Rasperry Pi
CO4	Deploy an IoT application and connect to the cloud.
CO5	Analyze applications of IoT in real time scenario

TEXT BOOKS
1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. 2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014 3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013 4. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

REFERENCES
1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
4. Jan Ho ¨ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.5.Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	1	-	-	-	-	-	1	1	-	3	2	2
CO2	3	2	2	2	1	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	2	1	2	2	1	2	2	-	2	3	3	2
CO5	3	3	3	2	1	2	2	1	1	1	1	2	3	3	3
CO	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**2**

Professional Elective – I
Semester - VI

YEAR		III	SEMESTER		VI	L	T	P	C
COURSE CODE / COURSE TITLE		191IT636 / OPEN SOURCE PROGRAMMING				3	0	0	3

COURSE OBJECTIVES
✓ To provide exposure in Open Source Software's and to develop new open source softwares for the benefit of the society.

SYLLABUS

UNIT-I	PHILOSOPHY	9
Linux, GNU and Freedom, Brief history of GNU, Licensing free software – GPL and copy Left, trends and potential – global and Indian, overview and usage of various Linux Distributions – user friendliness perspective – scientific perspective		

UNIT-II	SYSTEM ADMINISTRATION	9
GNU and linux installation — Boot process, Commands Using bash features, The man pages, files and file systems, File security, Partitions, Processes, Managing processes, I/O redirection, Graphical environment, Installing software, Backup techniques		

UNIT-III	FOSS PROGRAMMING PRACTICES	9
GNU debugging tools, Using source code versioning and managing tools, Review of common programming practices and guidelines for GNU/Linux and FOSS, Documentation		

UNIT-IV	PROGRAMMING TECHNIQUES	9
Application programming – Basics of X Windows server architecture – QT programming – GTK + Programming- Open source equivalent of existing Commercial software		

UNIT-V	PROJECTS AND CASE STUDIES	9
Linux for portable Devices, Creation of Bootable CD and USB from command line, Case Studies — Samba, Libre office, Assistive technology, Passbolt, Mozilla Thunderbird, Apache Web Server.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand the basics of Open Source Software's.
CO2	Gain Knowledge on Linux Installation and File systems.
CO3	Develop simple program suing FOSS
CO4	Develop QT programming
CO5	Gain knowledge on various to use Open Source software's.

TEXT BOOKS

1.Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, Linux in a nutshell, Sixthedition, OReilly media, September 2009.

REFERENCES

1. Philosophy of GNU URL: http://www.gnu.org/philosophy/
2. Overview of Linux Distributions URL: http://distrowatch.com/dwres.php?resource=major
3. Introduction to Linux – A Hands on Guide, URL: http://tldp.org/guides.html
4. **Linux:** Rute's User tutorial and exposition , URL: http://rute.2038bug.com/index.html.gz
5. Version control system , URL: http://git-scm.com/
6. SVN version control , URL: http://svnbook.red-bean.com/
7. Case study SAMBA: URL : http://www.samba.org/
8. Case study., Libre office: http://www.libreoffice.org/
9. Case study, ORCA: http://live.gnome.org/Orca

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT635 / INFORMATION THEORY AND CODING**			**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- Introduce the principles and applications of information theory.

- To teach study how information is measured in terms of probability and entropy.

- The relationships among conditional and joint correcting codes entropies.

- To teach coding schemes, including error.

SYLLABUS

UNIT-I	INFORMATION THEORY	9

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit

UNIT-II	SOURCE CODING: TEXT, AUDIO AND SPEECH	9

Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques -Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding

UNIT-III	SOURCE CODING: IMAGE AND VIDEO	9

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard

UNIT-IV	ERROR CONTROL CODING: BLOCK CODES	9

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes,Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder- low density parity checker

UNIT-V	ERROR CONTROL CODING: CONVOLUTIONAL CODES	9

Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm-Principle of Turbo coding

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Apply lossless source codes for discrete memoryless source to improve the efficiency of information.
CO2	Apply information theory and linear algebra in channel coding coding..
CO3	Implement the various types of source coding techniques for data compression.
CO4	Understand various error control encoding and decoding techniques
CO5	Analyze the performance of error control code.

TEXT BOOKS
1.R Bose, "InformationTheory, Coding and Crptography", TMH 2007 2.Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standardsrason Education Asia

REFERENCES
1.K Sayood, "Introduction to Data Compression" 3/e, Elsevier 2006 2.S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007 3.Amitabha Bhattacharya, "Digital Communication", TMH 2006

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT634 / EMBEDDED SYSTEM**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- ✓ Building Blocks of Embedded System
- ✓ Various Embedded Development Strategies
- ✓ Bus Communication in processors, Input/output interfacing.
- ✓ Various processor scheduling algorithms.
- ✓ Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

SYLLABUS	

UNIT-I	**INTRODUCTION TO EMBEDDED SYSTEMS**	9

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT-II	**EMBEDDED NETWORKING**	9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT-III	**EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT**	9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT-IV	**RTOS BASED EMBEDDED SYSTEM DESIGN**	9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT-V	**EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT**	9

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine – Digital camera

| **COURSE OUTCOMES** |
| On completion of the course, students will be able to |

CO1	Ability to understand and analyze Embedded systems.
CO2	Ability to study about the bus Communication in processors.
CO3	Ability to operate various Embedded Development Strategies
CO4	Ability to acquire knowledge on various processor scheduling algorithms.
CO5	Ability to suggest an embedded system for a given application.

TEXT BOOKS

1. Peckol, "Embedded system Design", John Wiley & Sons,2010
2. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
3. Shibu. K.V, "Introduction to Embedded Systems", 2e, Mc graw Hill, 2017.

REFERENCES

1. Raj Kamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. C.R.Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT633 / C# AND .NET PROGRAMMING**			3	0	0	3

COURSE OBJECTIVES

- ✓ 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)

SYLLABUS

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 ontype, marshalling, remoting, security in .NET

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyze the basic structure of a C# application
CO2	Implement Object Oriented concepts using C#
CO3	Build an windows application using .NET
CO4	Design and develop Web based applications on .NET
CO5	Understand the foundation of CLR &.net framework.

TEXT BOOKS

1.Herbert Schildt, "The Complete Reference: C# 4.0" , Tata McGraw Hill, 2012.
2.Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012..

REFERENCES

 1. Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
2. Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O"Reilly, 2010.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT632 / BIG DATA ANALYTICS**		3	0	0	3

COURSE OBJECTIVES

- ✓ To know the fundamental concepts of Big Data and Analytics.
- ✓ To explore tools and practices for working with Big data.
- ✓ To learn about stream computing.
- ✓ To know about the research that requires the integration of large amounts of data.

SYLLABUS

UNIT-I	INTRODUCTION TO BIG DATA	9

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Statistical concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT-II	DATA ANALYSIS	9

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks,Support vector and kernel methods, Analysis of time series: linear systems analysis, non linear dynamics, Decision Tree - Rule induction - Neural networks: learning and generalization, competitive learning,principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data,fuzzy decision trees, Stochastic search methods.

UNIT-III	MINING DATA STREAMS	9

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing,Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP)applications - case studies - real time sentiment analysis, stock market predictions.

UNIT-IV	FREQUENT ITEMSETS AND CLUSTERING	9

Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques –Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

UNIT-V	FRAMEWORKS AND VISUALIZATION	9

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques, Systems and applications, Industry challenges and application of Analytics.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyze the usage of modern data analytic tools and usage of statistical concepts.
CO2	Apply several key big data technologies used for storage, analysis and manipulation of data.
CO3	Apply Stream data concept to real time applications .
CO4	Use various clustering methods to evaluate the analytic process in bigdata.
CO5	Use Visualization techniques for Data Analytical problems..

TEXT BOOKS

1.Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012
2.David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL and Graph", Morgan Kaufmann/Elseiver Publishers, 2013.

REFERENCES

1.EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2015.
2.Kim H.Pries and Robert Dunnigan, "Big Data Analytics:A Practical Guide for Managers " CRC Press 2015Press 2015.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191IT631 / ADVANCED DATABASE TECHNOLOGY		3	0	0	3

COURSE OBJECTIVES

The student should be made to:

- Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.

- Be familiar with the relational database theory, and be able to write relational algebra expressions for querie

SYLLABUS

UNIT-I	PARALLEL AND DISTRIBUTED DATABASES	9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – ComProtocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies.

UNIT-II	OBJECT AND OBJECT RELATIONAL DATABASES	9

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems : Object Relational features in SQL / Oracle – Case Studies.

UNIT-III	XML DATABASES	9

XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC– Information Retrieval – Data Warehousing – Data Mining.

UNIT-IV	MOBILE DATABASES	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	INTELLIGENT DATABASES	9

Active databases – Deductive Databases – Knowledge bases – Multimedia Databases- Multidimensional Data Structure-Image Databases – Text/Document Databases- Video Databases– Audio Databases – Multimedia Database Design.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Develop transaction processing systems with concurrency control.
CO2	Create object database for real time applications.
CO3	Apply query evaluation techniques and query optimization techniques.
CO4	Develop web applications using web forms.
CO5	Design and develop a database application system as part of a team.

REFERENCES

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw H 2011.
2. C.J.Date, A.Kannan and S.Swamynathan,"An Introduction to Database Systems", Eighth Edition, Pearson Educat 2006.
3. R.Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison W 2007.
4. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.
5. Subramaniam, " Multimedia Databases", Morgan Kauffman Publishers, 2008.

Program Elective – II

Semester - VI

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT639 / INFORMATION RETRIEVAL SYSTEMS**			3	0	0	3

COURSE OBJECTIVES

- To use different information retrieval techniques in various application areas
- To apply IR principles to locate relevant information large collections of data
- To analyze performance of retrieval systems when dealing with unmanaged data sources
- To implement retrieval systems for web search tasks.

SYLLABUS		
UNIT-I	**INTRODUCTION**	**9**

Boolean retrieval. The term vocabulary and postings lists. Dictionaries and tolerant retrieval. Index construction. Index compression

UNIT-II	**PROBLEM SOLVING METHODS**	**9**

Scoring, term weighting, and the vector space model. Computing scores in a complete search system. Evaluation in information retrieval. Relevance feedback and query expansion.

UNIT-III	**KNOWLEDGE PRESENTATION**	**9**

XML retrieval. Probabilistic information retrieval. Language models for information retrieval. Text classification. Vector space classification.

UNIT-IV	**SOFTWARE AGENTS**	**9**

Support vector machines and machine learning on documents, Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.

UNIT-V	**APPLICATIONS**	**9**

Web search basics. Web crawling and indexes, Link analysis.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understanding the different techniques for compression of an index including the dictionary and its posting list
CO2	To implement retrieval systems for web search tasks.
CO3	Analyze the language models for information retrieval.
CO4	Apply Support vector machines and machine learning on documents.
CO5	To use different information retrieval techniques in various application areas

TEXT BOOKS

1.   Introduction to Information Retrieval , Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2008.

REFERENCES

1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, Springer.
2. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.
3. Information Retrieval: Algorithms and Heuristics, David A Grossman and Ophir Frieder, 2nd Edition, Springer, 2004.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	\multicolumn{3}{c}{**191IT638 / DIGITAL IMAGE PROCESSING**}		3	0	0	3

COURSE OBJECTIVES

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

SYLLABUS

UNIT-I	DIGITAL IMAGE FUNDAMENTALS	9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.

UNIT-II	IMAGE ENHANCEMENT	9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT-III	IMAGE RESTORATION	9

Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT-IV	IMAGE SEGMENTATION	9

Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT-V	IMAGE COMPRESSION AND RECOGNITION	9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
CO2	Operate on images using the techniques of smoothing, sharpening and enhancement.
CO3	Understand the restoration concepts and filtering techniques.
CO4	Understand the basics of segmentation, features extraction
CO5	Apply various compression and recognition methods for images.

TEXT BOOKS

- Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson India, Fourth Edition, 2018
- Anil K. Jain, "Fundamentals of Digital Image Processing ", **Pearson India**, 2015.

REFERENCES

- Sridhar.S, "Digital Image Processing", Second Edition, oxford university press, 2016.
- Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,"Digital Image Processing using MATLAB", Pearson, Inc., 2011.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT637 / ADVANCED JAVA PROGRAMMING**			3	0	0	3

COURSE OBJECTIVES
✓ To learn advanced Java programming concepts like interface, threads, Swings etc.   ✓ To develop network programs in Java   ✓ To understand Concepts needed for distributed and multi-tier applications   ✓ To understand issues in enterprise applications development.   ✓ To know about the various applications of AI.

SYLLABUS		
UNIT-I	**JAVA FUNDAMENTALS**	**9**
Java I/O streaming – filter and pipe streams – Byte Code interpretation - Threading –Swing.		
UNIT-II	**NETWORK PROGRAMMING IN JAVA**	**9**
Sockets – secure sockets – custom sockets – UDP datagram's – multicast sockets –URL classes– Reading Data from the server – writing data – configuring the connection– Reading the header – telnet application – Java Messaging services		
UNIT-III	**APPLICATIONS IN DISTRIBUTED ENVIRONMENT**	**9**
Remote method Invocation – activation models – RMI custom sockets – Object Serialization –RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models - JAR file creation		
UNIT-IV	**MULTI-TIER APPLICATION DEVELOPMENT**	**9**
Server side programming – servlets – Java Server Pages - Applet to Applet communication – Applet to Servlet communication - JDBC – Applications on databases – Multimedia streaming applications – Java Media Framework.		
UNIT-V	**ENTERPRISE APPLICATIONS**	**9**
Server Side Component Architecture – Introduction to J2EE – Session Beans – Entity Beans – Persistent Entity Beans.		

TEXT BOOKS
1. Elliott Rusty Harold, "Java Network Programming", O'Reilly publishers, 2000 2. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 1999. 3. Hortsmann & Cornell, "CORE JAVA 2 ADVANCED FEATURES, VOL II", Pearson Education, 2002.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Design and deploy websites
CO2	Design and deploy simple web application
CO3	Create simple database application
CO4	Develop information system
CO5	Understand the basics of networking and mobile communication

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	\multicolumn{3}{c	}{191IT6312 / WIRELESS SENSOR AND MESH NETWORKS}		3	0	0	3

COURSE OBJECTIVES

- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyze the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To have in depth knowledge on internetworking of WLAN and WWAN
- To learn about evolution of 4G Networks, its architecture and applications

SYLLABUS	

UNIT-I	WIRELESS LAN	9

Introduction-WLAN technologies: – IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hipper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, Wireless HART.

UNIT-II	MOBILE NETWORK LAYER	9

Introduction – 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, IoT: CoAP

UNIT-III	3G OVERVIEW	9

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

UNIT-IV	INTERNETWORKING BETWEEN WLANS AND WWANS	9

Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System

UNIT-V	4G & BEYOND	9

Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand the concept about Wireless networks, protocol stack and standards
CO2	Implement different type of applications for smart phones and mobile devices with latest network strategies
CO3	Conversant with the latest 3G networks and its architecture
CO4	Design and implement wireless network environment for any application using latest wireless protocols and standards
CO5	Conversant with the latest 4G networks and its architecture

TEXT BOOKS

1.Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.(Unit I,II,III)
2.Vijay Garg, ―Wireless Communications and networking, First Edition, Elsevier 2007.(Unit IV,V)

REFERENCES

1.Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband, Second Edition, Academic Press, 2008.
2.Anurag Kumar, D.Manjunath, Joy kuri, ―Wireless Networking, First Edition, Elsevier 2011.
3.Simon Haykin , Michael Moher, David Koilpillai, ―Modern Wireless Communications, First Edition,Pearson Education 2013

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191IT6310 / MOBILE COMPUTING		3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the basic concepts of mobile computing.
- ✓ To learn the basics of mobile telecommunication system.
- ✓ To be familiar with the network layer protocols and Ad-Hoc networks.
- ✓ To know the basis of transport and application layer protocols.
- ✓ To gain knowledge about different mobile platforms and application development

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT-II	MOBILE TELECOMMUNICATION SYSTEM	9

Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security

UNIT-III	MOBILE NETWORK LAYER	9

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT-IV	MOBILE TRANSPORT AND APPLICATION LAYER	9

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

UNIT-V	MOBILE PLATFORMS AND APPLICATIONS	9

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile OperatingSystems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues- UI implementation – Touch frameworks .

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand basics of mobile telecommunication systems
CO2	Compare the generations of telecommunication systems in wireless networks.
CO3	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
CO4	Analyze the functionalities of Transport and Application layers
CO5	Develop a mobile application using android/blackberry/ios/Windows SDK

TEXT BOOKS

1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2003.

2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCES

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.

2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.

3. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,TataMcGraw Hill Edition ,2006.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191IT6311 / MULTIMEDIA DATABASES			3	0	0	3

COURSE OBJECTIVES

- To understand the design of databases.
- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the emerging databases like Mobile, XML, Cloud and Big Data

SYLLABUS

UNIT-I	PARALLEL AND DISTRIBUTED DATABASES	9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

UNIT-II	INTELLIGENT DATABASES	9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications-Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases TSQL2- Deductive Databases-Recursive Queries in SQL- Spatial Databases- Spatial Data Types - Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

UNIT-III	XML DATABASES	9

XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases– Open Database Connectivity.

UNIT-IV	MOBILE DATABASES	9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols

UNIT-V	MULTIMEDIA DATABASES	9

Multidimensional Data Structures – Image Databases – Text / Document Databases – Video Databases – Audio Databases – Multimedia Database Design.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Create parallel and distributed databases for real time applications. To develop skills on databases to optimize their performance in practice.
CO2	Develop applications using Active database and Spatial database.
CO2	Understand the need for XML database.
CO3	To design faster algorithms in solving practical database problems
CO4	Analyze the Effect of Mobility on Data Management
CO5	Design a multimedia database using Multidimensional Data Structures.

REFERENCES

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers,2006.

3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2011.

4. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education/Addison Wesley, 2010.

5. Vijay Kumar, "Mobile Database Systems", John Wiley & Sons, 2006

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT62A / CLOUD COMPUTING LABAROTORY**			0	0	2	1

COURSE OBJECTIVES
✓ To develop web applications in cloud ✓ To learn the design and development process involved in creating a cloud based application ✓ To learn to implement and use parallel programming using Hadoop

	LIST OF EXPERIMENTS
1	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3	Install Google App Engine. Create hello world app and other simple web applications using python/java.
4	Use GAE launcher to launch the web applications.
5	Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.
6	Find a procedure to transfer the files from one virtual machine to another virtual machine.
7	Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
8	Install Hadoop single node cluster and run simple applications like word count.
9	Mount the one node Hadoop cluster using Fuse.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Install various virtualization tools such as Virtual Box, VMware workstation.
CO2	Use Cloud SIM to run various schedulers
CO3	Design a web application in an IaaS environment.
CO4	Develop a generic cloud environment which can be used as a private cloud
CO5	Implement version control systems with various command repositories

CO-PO & PSO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	3	1	1	-	-	-	-	2	2	2	1
CO2	3	3	3	2	3	1	1	-	-	-	-	2	3	2	2
CO3	3	3	3	2	3	2	2	2	2	2	2	2	3	3	2
CO4	3	3	3	2	3	2	2	2	2	2	2	2	3	3	2
CO5	3	3	3	2	3	2	1	-	2	-	-	2	3	2	2
CO	3	3	3	2	3	2	1	2	2	2	2	2	3	2	2

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT62B/SOFTWARE ENGINEERING PRACTICES LABORATORY**		0	0	2	1

COURSE OBJECTIVES
✓ Build a fully functional, interactive, layered, distributed, database-backed software system from the ground-up as part of a small, agile, development team in a laboratory setting ✓ Understand the phases of software projects and practice the activities of each phase. ✓ Become adapt such skills as distributed version control, unit testing, integration testing, build management, and deployment ✓ Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. ✓ Test the developed code and validate whether the SRS is satisfied.

	LIST OF EXPERIMENTS
1	Identify a software system that needs to be developed.
2	Document the Software Requirements Specification (SRS) for the identified system.
3	Identify use cases and develop the Use Case model.
4	Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5	Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6	Draw relevant State Chart and Activity Diagrams for the same system.
7	Implement the system as per the detailed design
8	Test the software system for all the scenarios identified as per the use case diagram
9	Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10	Implement the modified system and test it for various scenarios

Suggested domains for Mini-project.

1. Conference Management system.
2. Course reservation system
3. Credit card processing System
4. E-book management system

5. E-ticketing System

6. Exam Registration System

7. Library Management System

8. Passport System

9. Stock Maintenance System

10. Student Information System

11. Employee Payroll System

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Build a fully functional, interactive, layered, distributed, database-backed software system .
CO2	Use skills such as distributed version control, unit testing, integration testing, build management, and deployment
CO3	Draw standard UML diagrams using an UML modeling tool for a given case study and mapdesign to code and implement a 3 layered architecture
CO4	Test the developed code and validate whether the SRS is satisfied
CO5	Implement the modified system and test it for various scenarios

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	-	-	-	-	-	-	-	3	2	2
CO2	3	2	2	1	-	-	-	-	-	-	1	-	3	2	2
CO3	3	2	2	2	2	-	-	-	1	2	1	1	3	2	2
CO4	3	2	2	2	2	-	1	1	2	2	2	2	3	2	2
CO5	3	2	2	2	2	2	1	1	2	1	2	2	3	2	2
CO	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**2**	**2**

SEMESTER-VII

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT721 /MOBILE APPLICATION DEVELOPMENT**			3	0	0	3

COURSE OBJECTIVES

- ➢ Understand system requirements for mobile applications
- ➢ Generate suitable design using specific mobile development frameworks
- ➢ Generate mobile application design
- ➢ Implement the design using specific mobile development frameworks
- ➢ Deploy the mobile applications in marketplace for distribution

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT-II	BASIC DESIGN	9

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT-III	ADVANCED DESIGN	9

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT-IV	TECHNOLOGY I – ANDROID	9

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT-V	TECHNOLOGY II – IOS	9

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite –Sandboxing- Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Identify the requirements & validation technique of various mobile applications
CO2	Elucidate the challenges in developing mobile applications using basic design specification
CO3	Designing and accessing mobile application in a cloud computing environment
CO4	Implement the design of mobile app using Android SDK
CO5	Implement the design using Objective C and iOS. Deploy mobile applications in Android and iOS

TEXT BOOKS
1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2003.   2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd., New Delhi , 2012

REFERENCES
1. http://developer.android.com/develop/index.html   2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012   3. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012   4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012   5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6Development: Exploring the iOS SDK", Apress, 2013.

CO-PO & PSO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	2	1	1	-	-	2	-	-	2	3	3	3
CO3	3	3	3	3	1	1	-	-	2	-	-	2	3	3	3
CO4	3	3	3	3	1	1	-	-	2	-	-	2	3	3	2
CO5	3	3	3	2	1	1	-	-	2	-	-	2	3	3	2
CO	3	3	3	3	1	1	-	-	2	-	-	2	3	3	2

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191CS722-CRYPTOGRAPHY AND NETWORK SECURITY		3	0	0	3

COURSE OBJECTIVES

The student should be made to:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques
- To build protection mechanisms in order to secure computer networks.

SYLLABUS

UNIT-I	INTRODUCTION	9

Security trends , Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies, Model of network security, Security attacks, services and mechanisms, OSI security architecture, Mathematical Tools for Cryptography: Substitutions and Permutations Classical encryption techniques : substitution techniques, transposition techniques, steganography, Foundations of modern cryptography: perfect security, information theory, product cryptosystem , cryptanalysis.

UNIT-II	SYMMETRIC KEY CRYPTOGRAPHY	9

Mathematics of Symmetric Key Cryptography: Algebraic structures , Modular arithmetic, Euclid's algorithm, Congruence and matrices, Groups, Rings, Fields, Finite fields, Chinese remainder theorem-Symmetric Key Ciphers: SDES, Block cipher Principles of DES, Strength of 80 DES, Differential and linear cryptanalysis, Block cipher design principles, Block cipher mode of operation, Evaluation criteria for AES, Advanced Encryption Standard, IDEA ,RC4, Key distribution.

UNIT-III	PUBLIC KEY CRYPTOGRAPHY	9

Mathematics of Asymmetric Key Cryptography: Primes, Primality Testing, Factorization, Euler's totient function, Fermat's and Euler's Theorem, Chinese Remainder Theorem , Exponentiation and logarithm, Asymmetric Key Ciphers : RSA cryptosystem, Key distribution, Key management , Diffie Hellman key exchange, ElGamal cryptosystem , Elliptic curve arithmetic, Elliptic curve cryptography, Aggregation and Inference Direct Attacks.

UNIT-IV	MESSAGE AUTHENTICATION AND INTEGRITY	9

Authentication requirement, Authentication function , MAC , Hash function, Security of hash function and MAC, SHA, Digital signature and authentication protocols, DSS, Entity Authentication: Biometrics, Passwords, Challenge Response protocols, Authentication applications , Kerberos, X.509 ,P2P and Overlay Systems.

UNIT-V	SECURITY PRACTICE AND SYSTEM SECURITY	9

Electronic Mail security, PGP, S/MIME, IP security, Web Security, System Security : Intruders, Malicious software, viruses, Firewalls, Network Anomaly Detection and Routing Security, Secure electronic transaction (SET).

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Interpret the fundamentals of networks security, security architecture, threats and vulnerabilities.
CO2	Analyze the different cryptographic operations of symmetric cryptographic algorithms.
CO3	Understand & analyze cryptographic operations of public key cryptography.
CO4	Demonstrate the various Authentication schemes used in different applications.
CO5	Articulate various Security practices and System security standards.

TEXT BOOKS

1. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", 2nd ed, Pearson, 2007.
2. William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI, 4th ed, 2006.
3. Atul Kahate, "Cryptography and Network Security", McGraw Hill, 3rd ed, 2003

REFERENCES

1.W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007.
2. Charles P. Pfleeger, Shari Lawrence P fleeger – Security in computing Third Edition -Prentice Hall of India, 2006.

CO-PO & PSO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	-	2	-	-	2	1	3	2	2
CO2	3	3	3	2	1	-	-	2	1	-	2	1	3	3	2
CO3	3	3	2	1	1	1	-	2	1	-	2	1	3	3	2
CO4	3	3	3	1	1	2	-	2	1	2	2	1	3	3	2
CO5	3	3	3	2	2	2	2	2	-	1	2	1	3	2	2
CO	3	3	3	2	1	2	2	2	1	1	2	1	3	3	2

Program Elective -III (Semester - VII)

Course Code	Name of the Course	Category	L	T	P	Credits
191IT731	Blockchain Technologies	PE	3	0	0	3
191IT733	Semantic Web	PE	3	0	0	3
191IT736	Visualization Techniques	PE	3	0	0	3
191IT734	Service Oriented Architecture	PE	3	0	0	3
191IT732	Human Computer Interaction	PE	3	0	0	3
191IT735	Soft Computing	PE	3	0	0	3

Program Elective –III
(Semester - VII)

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT731/ BLOCKCHAIN TECHNOLOGIES**			3	0	0	3

COURSE OBJECTIVES
➢ To understand Blockchain's fundamental components, and examine decentralization using blockchain.   ➢ To elucidate how cryptocurrency works, from when a transaction is created to when it is considered part of the Blockchain.   ➢ To understand the components of Ethereum and Programming Languages for Ethereum.   ➢ To study the basics of Hyperledger and Web3.   ➢ To know about alternative Blockchains and Blockchain projects in different domains.

SYLLABUS	
UNIT-I	**INTRODUCTION TO BLOCKCHAIN**	**9**

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.

UNIT-II	**INTRODUCTION TO CRYPTOCURRENCY**	**9**

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts.

UNIT-III	**ETHEREUM**	**9**

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

UNIT-IV	**WEB3 AND HYPERLEDGER**	**9**

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT-V	**ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS**	**9**

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools

	COURSE OUTCOMES On completion of the course, students will be able to
CO1	Identify different approaches to developing decentralized applications.
CO2	Summarize Bitcoin and its limitations by comparing with other alternative coins.
CO3	Use solution using the Ethereum model.
CO4	Use Hyperledger and its development framework.
CO5	Discuss alternative Blockchains and analyze the emerging trends.

TEXT BOOKS

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014.
3. Roger Wattenhofer, "The Science of the Blockchain" CreateSpace Independent Publishing, 2016.
4. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
5. Alex Leverington, "Ethereum Programming" Packt Publishing, 2017.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT733 / SEMANTIC WEB		3	0	0	3

COURSE OBJECTIVES

➢ To learn the fundamentals of semantic web and to conceptualize and depict ontology for semanticweb.
➢ To make a study of languages for semantic web.
➢ To learn about the ontology learning algorithms and to utilize in the development of an application.
➢ To know the fundamental concepts of ontology management.
➢ To learn the applications related to semantic web.

SYLLABUS

UNIT-I	THE QUEST FOR SEMANTICS	9

Building Models – Calculating with Knowledge – Exchanging Information – Semantic Web Technologies – Layers – Architecture – Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Sample Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation.

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 –Methods for Evaluating Ontologies.

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 – Web Data Exchange and Syndication – Semantic Wikis – Semantic Portals – Semantic Metadata in Data Formats – Semantic Web in Life Sciences – Ontologies for Standardizations – Rule Interchange Format.

	COURSE OUTCOMES
On completion of the course, students will be able to	
CO1	Create ontology for a given domain.
CO2	Develop an application using ontology languages and tools.
CO3	Discuss the concepts of semantic web.
CO4	Use ontology related tools and technologies for application creation.
CO5	Use of Ontology tools for various applications

TEXT BOOKS

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.
2. 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.

REFERENCES

1. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004.
2. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer, 2002.
3. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology –Driven Knowledge Management", John Wiley, 2003.
4. John Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley,   2006.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT736 / VISUALIZATION TECHNIQUES**			3	0	0	3

COURSE OBJECTIVES

- ➢ To understand the fundamentals of data visualization.
- ➢ To know the working principles of various information visualization tools.
- ➢ To acquire knowledge about the issues in data representation.
- ➢ To visualize the complex engineering design.
- ➢ To gain skill in designing real time interactive Information visualization system.

SYLLABUS

UNIT-I	**INTRODUCTION**	9

Introduction – Visualization Stages – Computational Support – Issues – Different Types of Tasks – Data representation – Limitation: Display Space– Rendering Time – Navigation Links.

UNIT-II	**DATA REPRESENTATION**	9

Human Factors – Foundation for a Science of Data Visualization – Optics – Optimal Display – Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual Attention that Pops Out – Types of Data – Data Complexity – Encoding of Values – Encoding of Relation – Relation and Connection – Alternative Canvasses.

UNIT-III	**DATA PRESENTATION**	9

Human Vision – Space Limitation – Time Limitations – Design – Exploration of Complex Information Space – Figure Caption in Visual Interface – Visual Objects and Data Objects – Space Perception and Data in Space – Images, Narrative and Gestures for Explanation.

UNIT-IV	**INTERACTION**	9

Norman's Action Cycle – Interacting with Visualization – Interaction for Information Visualization – Interaction for Navigation – Interaction with Models – Interacting with Visualization – Interactive 3D Illustrations with Images and Text.

UNIT-V	**CURRENT TRENDS**	9

Design – Virtual Reality: Interactive Medical Application – Tactile Maps for visually challenged People – Animation Design for Simulation – Integrating Spatial and Nonspatial Data – Innovating the Interaction.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Collect data ethically and identify engineering problem in visualising the information.
CO2	Analyze various data representation methods.
CO3	Implement the data presentations for various applications.
CO4	Designing real time interactive Information visualization system.
CO5	Analyze and design systems to visualize multidisciplinary multivariate Data individually or in teams. Develop a cost effective and a scalable information visualization system.

TEXT BOOKS

1. Colin Ware, "Information Visualization Perception for Design", Third Edition, Morgan Kaufmann Publishers, 2012.
2. Robert Spence, "Information Visualization An Introduction", Third Edition, Pearson Education, 2014.

REFERENCES

1. Benjamin B. Bederson, Ben Shneiderman, "The Craft of Information Visualization" MorganKaufmann Publishers, 2003.
2. Thomas Strothotte, "Computational Visualization: Graphics, Abstraction and Interactivity",Springer, 1998.
3. Matthew O. Ward, George Grinstein, Daniel Keim, "Interactive Data Visualization: Foundation, Techniques and Applications", Second Edition, A. K. Peters/ CRC Press, 2015.
4. Robert Spence, "Information Visualization Design for Interaction", Second Edition, PearsonEducation, 2006.
5. Joerg Osarek, "Virtual Reality Analytics", Gordon's Arcade, 2016.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT734 / SERVICE ORIENTED ARCHITECTURE**		3	0	0	3

COURSE OBJECTIVES
➢ To learn fundamentals of XML ➢ To provide an overview of Service Oriented Architecture and Web services and their importance ➢ To learn web services standards and technologies ➢ To learn service oriented analysis and design for developing SOA based applications

SYLLABUS		
UNIT-I	**XML**	**9**
XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery		
UNIT-II	**SERVICE ORIENTED ARCHITECTURE (SOA) BASICS**	**9**
Characteristics of SOA, Benefits of SOA , Comparing SOA with Client-Server and Distributed architectures — Principles of Service Orientation – Service layers		
UNIT-III	**WEB SERVICES (WS) AND STANDARDS**	**9**
Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography		
UNIT-IV	**WEB SERVICES EXTENSIONS**	**9**
WS-Addressing – WS-Reliable Messaging – WS-Policy – WS-Coordination – WS -Transactions -WS-Security – Examples		
UNIT-V	**SERVICE ORIENTED ANALYSIS AND DESIGN**	**9**
SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines - Service design – Business process design – SOA Platforms-Basics-Layers-Relationship between SOA layers and Technologies-Case Study.		

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Understand the fundamental concepts of XML technologies
CO2	Identify the characteristics and benefits of SOA
CO3	Describe web services and WS standards
CO4	Use web services extensions to develop solutions
CO5	Apply service modeling, service oriented analysis and design for application development.

TEXT BOOKS

1. Thomas Erl, " Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005

2. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004

REFERENCES

1. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2003.

2. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2002.

3. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education,2002

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT732 / HUMAN COMPUTER INTERACTION**			3	0	0	3

COURSE OBJECTIVES

- ➢ To learn the principles and fundamentals of human computer interaction (HCI).
- ➢ To analyze HCI theories, as they relate to collaborative or social software.
- ➢ To understand components of interfaces and screens, including windows, menus and controls.
- ➢ To understand user interface design principles, and apply them to designing an interface.
- ➢ To understand the rationale and guidelines for an effective interface design methodology.

SYLLABUS

UNIT-I	DESIGN PROCESS	9

Humans – Information Process – Computer – Information Process – Differences and Similarities between them – Need for Interaction – Models – Ergonomics – Style – Context – Paradigms – Designing of Interactive Systems – Usability – Paradigm Shift – Interaction Design Basics – Design Process – Scenarios – Users Need –Complexity of Design.

UNIT-II	DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS	9

Software Process – Usability Engineering – Issue based Information Systems – Iterative Design Practices – Design Rules – Maximum Usability – Principles – Standards and Guidelines – Design Patterns – Programming Tools – Windowing Systems – Interaction Tool Kit – User Interface Management System – Evaluation Techniques – Evaluation Design – Evaluating Implementations – Observational Methods.

UNIT-III	MODELLING INTERFACES	9

Universal Design Principles – Multimodal Systems – User Support – Presentation and Implementation Issues – Types – Requirements – Approaches – Cognitive Model – Hierarchical Model – Linguistic Model – Physical and Device Models – Socio Technical Models – Communication and Collaboration Models – Task Models – Task Analysis And Design Dialogue Notations And Design – Dialogue Need – Dialogue Design Notations – Graphical – Textual – Representing Dialogue – Formal Descriptions – Dialogue Analysis – System Models – Interaction Models – Relationship With Dialogue – Formalisms –
Formal Notations – Interstitial Behavior.

UNIT-IV	EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI	9

Basic Design Structure – Single Independent Variable – Multiple Independent Variable – Factorial Design – Split-Plot Design – Random Errors – Experimental Procedure – Statistical Analysis – T Tests – Analysis of Variance Test – Regression – Chi-Square Test – Survey – Probabilistic Sampling – Non- Probabilistic Sampling – Developing Survey Questions.

UNIT-V	CURRENT TRENDS	9

Virtual Reality – Modeling Rich Interaction – Status Event Analysis – Properties – Rich Contexts – Sensor-Based Systems – Groupware – Applications – Ubiquitous Computing – Virtual Reality – Wearable User Interfaces – User Interfaces For MR Applications- Application of augmented reality Information and data visualization.

	COURSE OUTCOMES On completion of the course, students will be able to
CO1	Learn the fundamentals of Human Computer Interaction.
CO2	Apply HCI techniques and methods to the design a software.
CO3	Design an interface using different models.
CO4	Analyze various Statistical methods of HCI in different applications.
CO5	Design and develop real time Human Computer Interaction system.

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", ThirdEdition, Prentice Hall, 2004.
2. Preece, J., Sharp, H., Rogers, Y., "Interaction Design: Beyond Human-Computer Interaction",Fourth Edition, Wiley, 2015.

REFERENCES

1. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, "Research Methods in Human-Computer Interaction", Wiley, 2010.
2. Ben Shneiderman, Catherine Plaisant, "Designing the User Interface: Strategies for EffectiveHuman-Computer Interaction", Fifth Edition, Addison Wesley, 2009.
3. Jeff Johnson, "Designing with the Mind in Mind: Simple Guide to Understanding UserInterface Design Rules", Second Edition, Morgan Kaufmann, 2014.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT735 / SOFT COMPUTING		3	0	0	3

COURSE OBJECTIVES

- ➢ To give students knowledge of soft computing theories and fundamentals.
- ➢ To design a soft computing system required to address a computational task and use heuristicsbased on human experience.
- ➢ To understand fuzzy sets and fuzzy logic for problem solving.
- ➢ To become familiar with neural networks that can learn from available examples and generalizeto form appropriate rules for inferencing systems.
- ➢ To familiarize with genetic algorithms and other random search procedures useful while seekingglobal optimum in self-learning situations.

SYLLABUS

UNIT-I	FUZZY COMPUTING	9

Basic Concepts of Fuzzy Logic – Fuzzy Sets and Crisp Sets – Fuzzy Set Theory and Operations – Properties of Fuzzy Sets – Fuzzy and Crisp Relations – Fuzzy to Crisp Conversion – Membership Functions – Interference in Fuzzy Logic – Fuzzy If-Then Rules, Fuzzy-Implications and Fuzzy Algorithms – Fuzzifications and Defuzzificataions – Fuzzy Controller – Industrial Applications.

UNIT-II	FUNDAMENTALS OF NEURAL NETWORKS	9

Neuron, Nerve Structure and Synapse – Artificial Neuron and its Model – Activation Functions – Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks – Various Learning Techniques: Perception and Convergence Rule, Auto-Associative and Hetero- Associative Memory.

UNIT-III	BACK PROPAGATION NETWORKS	9

Back Propagation Networks Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model – Back Propagation Learning Methods – Effect of Learning Rule Co-Efficient – Factors Affecting Back Propagation Training – Applications.

UNIT-IV	COMPETETIVE NEURAL NETWORKS	9

Kohenen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization, Learning by LVQ – Adaptive Resonance Theory – Learning procedure – Applications.

UNIT-V	GENETIC ALGORITHM	9

Basic Concepts – Working Principle – Procedures of GA – Flow Chart of GA – Genetic Representation: (Encoding) Initialization and Selection – Genetic Operators: Mutation, Generational Cycle – Applications.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Identify and describe soft computing techniques and their roles in building intelligent machines
CO2	Recognize the feasibility of applying a soft computing methodology for a particular problem.
CO3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
CO4	Apply genetic algorithms to optimization problems
CO5	Design neural networks for pattern classification and regression problems. Compare different neural network approaches

TEXT BOOKS

1.S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and GeneticAlgorithm: Synthesis and Applications", Prentice Hall of India, 2010.
2.J.S.R. Jang, C.T. Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education,2004.

REFERENCES

1.S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Second Edition, Wiley-India,2007.
2. Siman Haykin, "Neural Networks", Prentice Hall of India, 1999.
3. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications, 2016.
4. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning",Pearson Education, 2008.

Program Elective -IV (Semester - VII)

Course Code	Name of the Course	Category	L	T	P	Credits
191IT7312	Software Testing	PE	3	0	0	3
191IT737	Computational Linguistics	PE	3	0	0	3
191IT7310	Machine Learning	PE	3	0	0	3
191IT739	Deep Learning	PE	3	0	0	3
191IT7311	Network Programming and Management	PE	3	0	0	3
191IT738	Data Mining Techniques	PE	3	0	0	3

Program Elective –IV
SEMESTER-VII

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT7312 / SOFTWARE TESTING		3	0	0	3

COURSE OBJECTIVES

- ➢ To introduce the basics and necessity of software testing.
- ➢ To provide various testing techniques along with concepts of software bugs and its impact.
- ➢ To develop and validate a test plan.
- ➢ To build a testing team required.
- ➢ To understand the need for and challenges in test automation and to develop testing scripts.

SYLLABUS

UNIT-I	TESTING PRINCIPLES AND AXIOMS	9

Testing as a Process – Testing Axioms –Software Testing Principles – Origins and Cost of Defects – Defect Classes and Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention Strategies.

UNIT-II	BLACK BOX, WHITE BOX TESTING AND TEST ADEQUACY	9

Test Case Design Strategies – Black Box Approach – Boundary Value Analysis – Equivalence Class Partitioning – State-Based Testing – User Documentation Testing – White Box Approach – Static Testing vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Cyclomatic Complexity – Test Adequacy Criteria

UNIT-III	LEVELS OF TESTING	9

Unit Test – Planning – Designing the Unit Test Process – Running the Unit Tests and Recording Results – Integration Test Planning – Scenario Testing – Defect Bash Elimination System Testing – Acceptance Testing – Performance Testing – Regression Testing – Internationalization Testing – Ad-Hoc Testing – Alpha, Beta Tests.

UNIT-IV	TEST MANAGEMENT	9

Organization Structures For Testing Teams – Testing Services – Test Planning Attachments – Locating Test Items – Test Management – Reporting Test Results – The Role of Three Groups in Test Planning and Policy Development – Introducing the Test Specialist – Skills Needed by a Test Specialist – Building a Testing Group.

UNIT-V	TEST AUTOMATION	9

Software Test Automation – Skill Needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Test Metrics and Measurements – Project, Progress and Productivity Metrics – Maintenance of Documents During Testing- Recent trends in Software test automation-Autonomous Testing-IoT Test Automation-Mobile Automation Testing.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Obtain an insight to software testing.
CO2	Apply both black box testing and white box testing.
CO3	Understand and apply multiple levels of testing.
CO4	Understand the role of a tester as an individual and as a team member.
CO5	Apply software testing for large projects using automated testing tools.Maintain documentation on testing.

TEXT BOOKS

1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Fourth Edition, CRC Press, 2013.
2. Dorothy Graham, Mark Fewster, "Experiences of Test Automation: Case Studies of Software Test Automation", Pearson Education, 2012.

REFERENCES

1. Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing", Third Edition, John Wiley & Sons, 2012.
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2009.
3. Boris Beizer, "Software Testing Techniques", Dream Tech Press, 2009.
4. Mauro Pezze, Michal Young, "Software Testing and Analysis Process Principles and Techniques", Wiley India, 2008.
5. Ali Mili, Fairouz Chier, "Software Testing: Concepts and Operations", Wiley, 2015.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191IT737 / COMPUTATIONAL LINGUISTICS			3	0	0	3

COURSE OBJECTIVES
➢ To gain knowledge about the fundamentals of language processing.   ➢ To study about the language parsing and recognition.   ➢ To gain knowledge on statistical language modeling.   ➢ To understand the fundamentals of computational linguistic models.   ➢ To engage in critical thinking regarding the applicability of computation linguistic models tovarious real world applications.

SYLLABUS		
UNIT-I	FOUNDATIONS	9
\multicolumn{3}{l}{Formal Language Theory – Language Classes and Linguistic Formalisms – Regular Languages – Context-Free Languages – The Chomsky Hierarchy – Mildly Context-Sensitive Languages.}		
UNIT-II	COMPUTATIONAL COMPLEXITY IN NATURAL LANGUAGE	9
\multicolumn{3}{l}{Turing Machines and Models of Computation – Parsing and Recognition – Complexity and Semantics – Determining Logical Relationships between Sentences.}		
UNIT-III	STATISTICAL LANGUAGE MODELING	9
\multicolumn{3}{l}{Introduction – Measures of Language Model Quality – Structured Language Model – Probabilistic Model – Theory of Parsing – Context–Free Grammars and Recognition – Context-Free Parsing – Probabilistic Parsing – Lexicalized Context-Free Grammars – Dependency Grammars – Tree Adjoining Grammars – Automatic Translation.}		
UNIT-IV	COMPUTATIONAL LINGUISTIC MODELS	9
\multicolumn{3}{l}{Maximum Entropy Models – Memory-Based Learning – Decision Trees – Unsupervised Learning and Grammar Induction – Artificial Neural Networks – Linguistic Annotation – Evaluation of NLP Systems.}		
UNIT-V	DOMAINS OF APPLICATION	9
\multicolumn{3}{l}{Speech Recognition – Statistical Parsing – Segmentation and Morphology – Computational Semantics – Information Extraction – Natural Language Generation – Question Answering.}		

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Understand basic principles behind formal language theory and grammar.
CO2	Apply statistical language processing for domain specific applications.
CO3	Recognize and represent knowledge semantics using parsing.
CO4	Use linguistic models for analyzing text data.
CO5	Develop simple applications using language models.

TEXT BOOKS

1. Ruslan Mitkov, "The Oxford Handbook of Computational Linguistics", Oxford University Press, 2003.

REFERENCES

1. Rodolfo Delmonte, "Computational Linguistics, Text Processing: Logical Form, Semantic Interpretation, Discourse Relations and Question Answering", Nova Science Publishers, 2007.
2. Alfio Gliozzo, Cailo Strapparava, "Semantic Domain in Computational Linguistics", Springer, 2009.
3. James H. Martin and Daniel Jurafsky, "Speech and language processing: An Introduction to Natural Language Processing, Computational Li.2013.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT7310 / MACHINE LEARNING		3	0	0	3

COURSE OBJECTIVES

- ➢ To understand the basic concepts of machine learning and probability theory.
- ➢ To appreciate supervised learning and their applications.
- ➢ To understand unsupervised learning like clustering and EM algorithms.
- ➢ To understand the theoretical and practical aspects of probabilistic graphical models.
- ➢ To learn other learning aspects such as reinforcement learning, representation learning, deep learning, neural networks and other technologies.

SYLLABUS

UNIT-I	INTRODUCTION	9

Machine Learning – Types of Machine Learning – Supervised Learning – Unsupervised Learning – Basic Concepts in Machine Learning – Machine Learning Process – Weight Space – Testing Machine Learning Algorithms – A Brief Review of Probability Theory –Turning Data into Probabilities – The Bias-Variance Tradeoff.

UNIT-II	SUPERVISED LEARNING	9

Linear Models for Regression – Linear Basis Function Models – The Bias-Variance Decomposition – Bayesian Linear Regression – Common Regression Algorithms – Simple Linear Regression – Multiple Linear Regression – Linear Models for Classification – Discriminant Functions – Probabilistic Generative Models – Probabilistic Discriminative Models – Laplace Approximation – Bayesian Logistic Regression – Common Classification Algorithms – k-Nearest Neighbors – Decision Trees – Random Forest model – Support Vector Machines

UNIT-III	UNSUPERVISED LEARNING	9

Mixture Models and EM – K-Means Clustering – Dirichlet Process Mixture Models – Spectral Clustering – Hierarchical Clustering – The Curse of Dimensionality – Dimensionality Reduction – Principal Component Analysis – Latent Variable Models(LVM) – Latent Dirichlet Allocation (LDA).

UNIT-IV	GRAPHICAL MODELS	9

Bayesian Networks – Conditional Independence – Markov Random Fields – Learning – Naive Bayes Classifiers – Markov Model – Hidden Markov Model.

UNIT-V	ADVANCED LEARNING	9

Reinforcement Learning – Representation Learning – Neural Networks – Active Learning – Ensemble Learning – Bootstrap Aggregation – Boosting – Gradient Boosting Machines – Deep Learning.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Choose and implement classification or regression algorithms for an application using an open source tool.
CO2	Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
CO3	Use a tool to implement typical clustering algorithms for different types of applications
CO4	Design and implement an HMM for a sequence model type of application.
CO5	Implement appropriate learning algorithms for any real time application using an open source tool.

TEXT BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", Third Edition, Prentice Hall of India, 2015.

REFERENCES

1. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, CRC Press, 2014.
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 2017.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Second Edition, Springer, 2008.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT739 / DEEP LEARNING		3	0	0	3

COURSE OBJECTIVES

- ➢ To understand the basic ideas and principles of neural networks.
- ➢ To understand the basic concepts of deep learning.
- ➢ To familiarize with image processing facilities like TensorFlow and Keras.
- ➢ To appreciate the use of deep learning applications.
- ➢ To understand and implement deep learning architectures.

SYLLABUS

UNIT-I	BASICS OF NEURAL NETWORKS	9

Basic Concept of Neurons – Perceptron Algorithm – Feed Forward and Backpropagation Networks.

UNIT-II	INTRODUCTION TO DEEP LEARNING	9

Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation and Other Differentiation Algorithms – Vanishing Gradient Problem – Mitigation – Rectified Linear Unit (ReLU) – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training –Nestors Accelerated Gradient Descent – Regularization for Deep Learning – Dropout – Adversial Training – Optimization for Training Deep Models.

UNIT-III	CONVOLUTIONAL NEURAL NETWORKs	9

CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – Recurrent and Recursive Nets – Recurrent Neural Networks – Deep Recurrent Networks – Recursive Neural Networks – Applications.

UNIT-IV	ADDITIONAL DEEP LEARNING ARCHITECTURES	9

Long Short Term Memory (LSTM) Networks – Sequence Prediction – Gated Recurrent – Encoder/Decoder Architectures – Autoencoders – Standard – Sparse – Denoising – Contractive – Variational Autoencoders – Applications of Autoencoders – Representation Learning – Deep generative Models – Deep Belief Networks – Deep Generative Networks – Generative Schemes – Evaluating Generative Models.

UNIT-V	APPLICATIONS OF DEEP LEARNING	9

Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Understand the role of deep learning in machine learning applications.
CO2	Get familiar with the use of TensorFlow and Keras in deep learning applications.
CO3	Critically analyze different deep learning models in image related projects.
CO4	Design and implement convolutional neural networks.
CO5	Know about applications of deep learning in NLP and image processing.

TEXT BOOKS

1. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018

REFERENCES

1. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress, 2017.
2. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRCPress, 2018.
3. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
4. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT7311 / NETWORK PROGRAMMING AND MANAGEMENT		3	0	0	3

COURSE OBJECTIVES

- ➢ To learn the basics of socket programming using TCP Sockets.
- ➢ To learn about socket options.
- ➢ To explore the features of raw sockets.
- ➢ To learn and develop macros for including objects in MIB structure.
- ➢ To have knowledge on various network management tools.

SYLLABUS

UNIT-I	SOCKETS AND APPLICATION DEVELOPMENT	9

Introduction to Socket Programming – System Calls – Address Conversion Functions – POSIX Signal Handling – Server with Multiple Clients – Boundary Conditions – Server Process Crashes, Server Host Crashes, Server Crashes and Reboots, Server Shutdown – I/O Multiplexing – I/O Models – TCP Echo Client/Server with I/O Multiplexing.

UNIT-II	SOCKET OPTIONS	9

Socket Options – getsockopt and setsockopt Functions – Generic Socket Options – IP Socket Options – ICMP Socket Options – TCP Socket Options – Multiplexing TCP and UDP Sockets – Domain Name System – gethostbyname, gethostbyaddr, getservbyname and getservbyport functions – Protocol Independent Functions – getaddrinfo and freeaddrinfo Functions.

UNIT-III	ADVANCED SOCKETS	9

IPv4 and IPv6 Interoperability – Threaded Servers – Thread Creation and Termination – TCP Echo Server using Threads – Mutex – Condition Variables – Raw Sockets – Raw Socket Creation – Raw Socket Output – Raw Socket Input – Ping Program – Trace Route Program.

UNIT-IV	SIMPLE NETWORK MANAGEMENT	9

SNMP Network Management Concepts – SNMPv1 – Management Information – MIB Structure – Object Syntax – Standard MIB's – MIB–II Groups – SNMPv1 Protocol and Practical Issues – Overview of RMON – Statistics and Collection – Alarms and Filters.

UNIT-V	NETWORK MANAGEMENT TOOLS & SYSTEMS	9

System Utilities – Network Status Tools – Traffic monitoring Tools – Network Routing Tools – SNMP Tools – Network Statistics measurement systems – NMS Design – Network Management Systems.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Implement client/server communications using TCP and UDP Sockets.
CO2	Describe the usage of socket options for handling various Sockets in programming.
CO3	Understand handling of raw sockets, functionalities of SNMP and MIB structure.
CO4	Experiment with various tools available to manage a network.
CO5	Handle technical issues in a network.

TEXT BOOKS

1. W. Richard Stevens, "UNIX Network Programming Vol I", Third Edition, PHI/ Pearson Education, 2003.
2. William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Third Edition, Pearson Education, 2009.

REFERENCES

1. D.E. Comer, "Internetworking with TCP/IP , Vol–I", Sixth Edition, Pearson Edition, 2013.
2. D. E. Comer, "Internetworking with TCP/IP Vol–III: Client–Server Programming and Application BSD Sockets Version", Second Edition, Pearson Education, 2003.
3. Mani Subramanian, "Network Management – Principles and Practice", Second Edition, Pearson Education, 2013

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT738 / DATA MINING TECHNIQUES		3	0	0	3

COURSE OBJECTIVES

- ➢ To learn the background of data mining
- ➢ To understand data basics
- ➢ To get familiar with basics of data mining problems
- ➢ To learn the clustering and classification techniques
- ➢ To learn the basics of association rule mining and visualization.

SYLLABUS

UNIT-I	INTRODUCTION TO DATA MINING	9

Introduction to Data Mining – Data Mining Tasks – Components of Data Mining Algorithms – Data Mining supporting Techniques – Major Issues in Data Mining – Measurement and Data – Data Preprocessing – Data sets.

UNIT-II	OVERVIEW OF DATA MINING ALGORITHMS	9

Overview of Data Mining Algorithms – Models and Patterns – The Reductionist viewpoint on Data Mining Algorithms – Score function for Data Mining Algorithms – Fundamentals of Modeling – Model Structures for Prediction – Models for probability Distributions and Density functions – The Curve of Dimensionality – Models for Structured Data – Scoring Patterns.

UNIT-III	CLASSIFICATIONS	9

Classifications – Basic Concepts – Decision Tree induction – Bayes Classification Methods – Rule Based Classification – Model Evaluation and Selection – Techniques to Improve Classification Accuracy.

UNIT-IV	CLUSTER ANALYSIS	9

Cluster Analysis: Basic concepts and Methods – Cluster Analysis – Partitioning methods – Hierarchical methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering – Advanced Cluster Analysis: Probabilistic model based clustering – Clustering High – Dimensional Data – Clustering Graph and Network Data – Clustering with Constraints.

UNIT-V	ASSOCIATION RULE MINING AND VISUALIZATION	9

Association Rule Mining – Introduction – Large Item sets – Basic Algorithms – Parallel and Distributed Algorithms – Comparing Approaches – Incremental Rules - Visualization of Multidimensional Data – Diagrams for Multidimensional visualization – Visual Data Mining – Data Mining Applications – Case Study: WEKA.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand background of data mining.
CO2	Analyze the various Data Mining algorithms
CO3	Apply classification techniques to different problems.
CO4	Proficiency with the data mining techniques.
CO5	Proficiency with the ARM and visualization

TEXT BOOKS

1. P.N. Tan, M. Steinbach, and V. Kumar, Introduction to Data Mining, Addison Wesley, 2005.
2. Mohammed J. Zaki, Wagner Meira Jr., Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge Press, 2014.
3. Data Mining Concepts and techniques, by Han and Kamber, Morgan Kaufmann, 2nd, 2009. Other Supplemental Material:

REFERENCES

1. Jiawei Han, Micheline Kamber , Jian Pei, "Data Mining: Concepts and Techniques", Third Edition (The MorganKaufmann Series in Data Management Systems), 2012.
2. David J. Hand, Heikki Mannila and Padhraic Smyth "Principles of Data Mining" (Adaptive Computation andMachine Learning), 2005
3. Margaret H Dunham, "Data Mining: Introductory and Advanced Topics", 2003
4. Soman, K. P., Diwakar Shyam and Ajay V. "Insight Into Data Mining: Theory And Practice", PHI, 2009.

Program Elective -V (Semester - VII)

Course Code	Name of the Course	Category	L	T	P	Credits
191IT7316	IoT Based Smart Systems	PE	3	0	0	3
191IT7313	Ethical Hacking	PE	3	0	0	3
191IT7314	Full Stack Software Development	PE	3	0	0	3
191IT7318	Quantum Computing	PE	3	0	0	3
191IT7315	Game Programming	PE	3	0	0	3
191IT7317	Pattern Recognition	PE	3	0	0	3

Program Elective –V
SEMESTER-VII

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT7316 / IOT BASED SMART SYSTEMS**		3	0	0	3

COURSE OBJECTIVES
➢ To understand smart objects and IoT Architectures.   ➢ To learn about various IoT related protocols.   ➢ To build simple IoT systems using open hardware such as Arduino and Raspberry Pi.   ➢ To understand data analytics and cloud in the context of IoT.   ➢ To build IoT based smart systems.

SYLLABUS		
UNIT-I	**FUNDAMENTALS OF IoT**	**9**
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Open Hardware Platforms for IoT.		
UNIT-II	**IoT PROTOCOLS - I**	**9**
IoT Access Technologies: Physical and MAC Layers, Topology and Security of IEEE 802.15.4, 1901.2a, 802.11ah and LoRaWAN – Network Layer: Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo.		
UNIT-III	**IoT PROTOCOLS - II**	**9**
Routing over Low Power and Lossy Networks (RPL) – Application Transport Methods: Application Layer Not Present, Supervisory Control and Data Acquisition (SCADA) – Application Layer Protocols: CoAP and MQTT – Service discovery – mDNS.		
UNIT-IV	**CLOUD, FOG AND DATA ANALYTICS FRAMEWORKS**	**9**
Cloud and Fog Topologies – Cloud Services Model – Fog Computing – Structured versus Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics –Security in IoT – CISCO IoT System – IBM Watson IoT Platform.		
UNIT-V	**APPLICATIONS**	**9**
Smart and Connected Cities: Street Layer, City Layer, Data Center Layer and Services Layer, Street Lighting, Smart Parking Architecture and Smart Traffic Control – Smart Transportation – Connected Cars.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand the concept and architecture of IoT.
CO2	Choose the right sensors and actuators for an application.
CO3	Analyze various protocols for IoT.
CO4	Apply data analytics and use cloud/fog offerings related to IoT.
CO5	Analyze applications of IoT in real time scenario. Design an IoT based smart system.

TEXT BOOKS

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

REFERENCES

1. Perry Lea, "Internet of things for architects", Packt, 2018.
2. Jan Ho¨ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a NewAge of Intelligence", Elsevier, 2014.
3. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – KeyApplications and Protocols", Wiley, 2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
5. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", UniversitiesPress, 2015.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT7313 / ETHICAL HACKING		3	0	0	3

COURSE OBJECTIVES

➢ To explore the concepts of security testing and the knowledge required to protect against thehacker and attackers.

➢ To understand reconnaissance and the publicly available tools used to gather information on potential targets.

➢ To discover the scanning techniques used to identify network systems open ports.

➢ To identify network system vulnerabilities and confirm their exploitability.

➢ To explore techniques for identifying web application vulnerabilities and attacks.

SYLLABUS

UNIT-I	INTRODUCTION TO HACKING	9

Introduction to Hacking – Important Terminologies – Penetration Test – Vulnerability Assessmentsversus Penetration Test – Pre-Engagement – Rules of Engagement – Penetration Testing Methodologies
– OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests –
Vulnerability Assessment Summary – Reports.

UNIT-II	INFORMATION GATHERING AND SCANNING	9

Information Gathering Techniques – Active Information Gathering – Passive Information Gathering – Sources of Information Gathering – Tracing the Location – Traceroute – ICMP Traceroute – TCP Traceroute – Usage – UDP Traceroute – Enumerating and Fingerprinting the Webservers – Google Hacking – DNS Enumeration – Enumerating SNMP – SMTP Enumeration – Target Enumeration and Port Scanning Techniques – Advanced Firewall/IDS Evading Techniques.

UNIT-III	NETWORK ATTACKS	9

Vulnerability Data Resources – Exploit Databases – Network Sniffing – Types of Sniffing – Promiscuous versus Nonpromiscuous Mode – MITM Attacks – ARP Attacks – Denial of Service Attacks
–Hijacking Session with MITM Attack – SSL Strip: Stripping HTTPS Traffic –DNS Spoofing – ARP Spoofing Attack Manipulating the DNS Records – DHCP Spoofing – Remote Exploitation – Attacking Network Remote Services – Overview of Brute Force Attacks – Traditional Brute Force – Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication.

UNIT-IV	EXPLOITATION	9

Introduction to Metasploit – Reconnaissance with Metasploit – Port Scanning with Metasploit – Compromising a Windows Host with Metasploit – Client Side Exploitation Methods – E–Mails with Malicious Attachments – Creating a Custom Executable – Creating a Backdoor with SET – PDF Hacking
– Social Engineering Toolkit – Browser Exploitation – Post–Exploitation – Acquiring Situation Awareness –
Hashing Algorithms – Windows Hashing Methods – Cracking the Hashes – Brute force
Dictionary Attacks – Password Salts – Rainbow Tables – John the Ripper – Gathering OS Information –
Harvesting Stored Credentials.

UNIT-V	WIRELESS AND WEB HACKING	9
	Wireless Hacking – Introducing Aircrack– Cracking the WEP – Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng – Evil Twin Attack – Causing Denial of Service on the Original AP – Web Hacking – Attacking the Authentication – Brute Force and Dictionary Attacks – Types of Authentication – Log-In Protection Mechanisms – Captcha Validation Flaw – Captcha RESET Flaw – Manipulating User-Agents to Bypass Captcha and Other Protection – Authentication Bypass Attacks – Testing for the Vulnerability – Automating It with Burp Suite – Session Attacks – SQL Injection Attacks – XSS (Cross- Site Scripting) – Types of Cross-Site Scripting – Cross-Site Request Forgery (CSRF) – SSRF Attacks.	

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Use the various security tools to assess the computing system.
CO2	Predict the vulnerabilities across any computing system using penetration testing.
CO3	Identify prediction mechanism to prevent any kind of attacks.
CO4	Ability to protect the system from being attacked by metasploit users.
CO5	Evaluate the wireless network flaws and able to apply security patches.

TEXT BOOKS

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.

REFERENCES

1. Kevin Beaver, "Ethical Hacking for Dummies", Sixth Edition, Wiley, 2018.
2. Jon Erickson , "Hacking: The Art of Exploitation", Second Edition, Rogunix, 2007.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT7314 / FULL STACK SOFTWARE DEVELOPMENT**		3	0	0	3

COURSE OBJECTIVES

- ➤ To get an overview of the full stack software and web development.
- ➤ To understand the object oriented structure and user interface programming through Python.
- ➤ To gain knowledge of web development using Flask Framework.
- ➤ To learn the web application deployment in real time scenarios.
- ➤ To learn to deploy the software in Linux and Windows platforms.

SYLLABUS

UNIT-I	OBJECT ORIENTED APPROACH IN PYTHON	9

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading – CustomizingBehavior Methods – Constructors – Polymorphism – Inheritance.

UNIT-II	USER INTERFACE APPLICATIONS IN PYTHON AND VERSION CONTROL SYSTEM	9

Wxpython installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics – Collaborative Version Control Systems – Git Commands – Real Time Usage of Git Commands.

UNIT-III	FLASK FRAMEWORK FOR WEB DEVELOPMENT	9

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules – Connection with Databases – Relational Database versus NoSQL – Modeling – Mapping Classes to Mongodb – Building Data Layer with Mongo Engine.

UNIT-IV	REAL TIME DEPLOYMENT OF WEB APPLICATION	9

Deploy Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – AutoEvaluation of Student Assignments – Deployment Using AWS or Google Cloud or Heroku.

UNIT-V	DEPLOYMENT OF SOFTWARE IN LINUX AND WINDOWS PLATFORM	9

Deployment in Ubuntu Distribution – Creation of .Deb Executable File – Deployment in Windows –Creation of Standalone Executable – Test Cases.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Understand the object oriented approach in Python.
CO2	Develop GUI applications with Python.
CO3	Use the collaborative version control system, git.
CO4	Package the developed code in Linux and Windows environment.
CO5	Deploy the developed web application using Flask in real time scenarios such as

TEXT BOOKS
1. Mark Lutz, "Learning Python", Fifth Edition, O' Reilly 2013. 2. Scott Chacon and Ben Straub, "Pro Git", Free e-book under Creative commons, Second Edition,Apress, 2016. 3. Miguel Grinberg, "Flask Web Development Developing Web Applications with Python", OReilly, 2014

REFERENCES
1. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the-little-mongodb-book. 2. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191IT7318 / QUANTUM COMPUTING			3	0	0	3

COURSE OBJECTIVES

➢ To know the background of classical computing and quantum computing.
➢ To learn the fundamental concepts behind quantum computation.
➢ To study the details of quantum mechanics and the relation to Computer Science.
➢ To gain knowledge about the basic hardware and mathematical models of quantum computation.
➢ To learn the basics of quantum information and the theory behind it.

SYLLABUS

UNIT-I	FUNDAMENTAL CONCEPTS	9

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – ExperimentalQuantum Information Processing – Quantum Information.

UNIT-II	QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS	9

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application: SuperdenseCoding – Density Operator – The Shmidt Decomposition and Purifications – EPR and the Bell Inequality
– Computational Models: Turing Machines – Circuits – Analysis of Computational Problems.

UNIT-III	QUANTUM COMPUTATION	9

Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model ofComputation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers.

UNIT-IV	QUANTUM INFORMATION	9

Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations
– Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction –Entropy.

UNIT-V	QUANTUM INFORMATION THEORY	9

Quantum States and Accessible Information – Data Compression – Classical Information Over Noisy Quantum Channels – Quantum Information Over Noisy Quantum Channels – Entanglement as a Physical Resource – Quantum Cryptography.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the basics of quantum computing.
CO2	Understand the background of Quantum Mechanics.
CO3	Analyze the computation models.
CO4	Implement Quantum operations for real time applications.
CO5	Understand Noisy channels and Quantum Cryptography.

TEXT BOOKS

1. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information",Tenth Edition, Cambridge University Press, 2010.

REFERENCES

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge UniversityPress, 2007.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT7315 / GAME PROGRAMMING**		3	0	0	3

COURSE OBJECTIVES

- ➢ To know the basics of 2D and 3D graphics for game development.
- ➢ To know the stages of game development.
- ➢ To understand the basics of game engine.
- ➢ To survey the gaming development environment and toolkits.
- ➢ To learn and develop simple games using Pygame environment.

SYLLABUS

UNIT-I	3D GRAPHICS FOR GAME PROGRAMMING	9

Game – Definition – Genres of Games, Basics of 2D and 3D Graphics, Game Objects Design – 2D and 3D Transformations – Projections – Colour Models – Illumination and Shader Models – Animation – Controller based Animation.

UNIT-II	GAME DESIGN PRINCIPLES	9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration –Game Balancing –Core Mechanics – Principles of Level Design – Proposals – Writing for Pre-production, Production and Post-Production.

UNIT-III	GAME ENGINE DESIGN	9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms –Algorithms for Game Engine – Collision Detection – Game Logic – Game AI – Path Finding.

UNIT-IV	OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS	9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity –Singleplayer and Multi-Player games.

UNIT-V	GAME DEVELOPMENT USING PYGAME	9

Developing 2D and3D Interactive Games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating Music and Sound – Asset Creations – Game Physics Algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based Games – Overview of Puzzle Games.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Have knowledge on the concepts of 2D and 3D graphics.
CO2	Know about games and their genres with their origin and history.
CO3	Prepare game design documents.
CO4	Understand the implementation of gaming engines.
CO5	Implement a simple game in Pygame.

TEXT BOOKS

1.Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison-Wesley Professional, 2013.

REFERENCES

1. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress Publishers, 2007.
2. Paul Craven, "Python Arcade games", Apress Publishers, 2016.
3. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics",Second Edition, CRC Press, 2006.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191IT7317 / PATTERN RECOGNITION**			3	0	0	3

COURSE OBJECTIVES

- ➢ To provide basic knowledge about the fundamentals of pattern recognition and its applications.
- ➢ To understand about unsupervised algorithms suitable for pattern classification.
- ➢ To familiarize with the feature selection algorithms and methods of implementing them in applications.
- ➢ To learn about the basis of algorithms used for training and testing the dataset.
- ➢ To learn basic fuzzy system and neural network architectures, for applications in pattern recognition, image processing, and computer vision.

SYLLABUS

UNIT-I	PATTERN CLASSIFIER	9

Overview of Pattern Recognition – Discriminant Functions – Supervised Learning – Parametric Estimation – Maximum Likelihood Estimation – Bayes Theorem – Bayesian Belief Network, Naive Bayesian Classifier.

UNIT-II	CLUSTERING	9

Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering – Density Based Clustering.

UNIT-III	FEATURE EXTRACTION AND SELECTION	9

Entropy Minimization – Karhunen Loeve Transformation – Feature Selection Through Functions Approximation – Binary Feature Selection – KNN.

UNIT-IV	HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINES	9

State Machines – Hidden Markov Models: Maximum Likelihood for the HMM, The Forward and Backward Algorithm, Sum-Product Algorithm for the HMM, Scaling Factors, The Viterbi Algorithm, Extensions Of The Hidden Markov Model – Support Vector Machines: Maximum Margin Classifiers, Relevance Vector Machines.

UNIT-V	RECENT ADVANCES	9

Fuzzy Classification: Fuzzy Set Theory, Fuzzy And Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition – Introduction to Neural Networks: Elementary Neural Network For Pattern Recognition, Hebbnet, Perceptron, ADALINE, Back Propagation

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Implement basic pattern classifier algorithms.
CO2	Have knowledge about the working principle of unsupervised algorithms.
CO3	Have knowledge about functionality of classifiers.
CO4	Perceive the recent advancement in pattern recognition.
CO5	Apply SVM and HMM algorithms for real time applications

REFERENCES

1. R. O. Duda, P. E. Hart, D. G. Stork, "Pattern Classification", John Wiley, 2001.
2. M. Narasimha Murthy, V. Susheela Devi, "Pattern Recognition", Springer 2011.
3. Menahem Friedman, Abraham Kandel, "Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches", World Scientific publishing Co. Ltd, 2000.
4. S. Theodoridis, K. Koutroumbas, "Pattern Recognition", Fourth Edition, Academic Press, 2009.

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT72A / MOBILE APPLICATION DEVELOPMENT LABORATORY**		**0**	**0**	**2**	**1**

COURSE OBJECTIVES

- ➢ To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- ➢ To understand how to work with various mobile application development frameworks.
- ➢ To learn the basic and important design concepts and issues of development of mobile applications.
- ➢ To understand the capabilities and limitations of mobile devices.
- ➢ To develop simple and location specific applications in android environment

LIST OF EXPERIMENTS

1	Develop an application that uses GUI components, Font and Colours
2	Develop an application that uses Layout Managers and event listeners.
3	Write an application that draws basic graphical primitives on the screen.
4	Develop an application that makes use of databases.
5	Develop an application that makes use of Notification Manager
6	Implement an application that uses Multi-threading
7	Develop a native application that uses GPS location information
8	Implement an application that writes data to the SD card.
9	Implement an application that creates an alert upon receiving a message
10	Write a mobile application that makes use of RSS feed
11	Develop a mobile application to send an email.
12	Develop a Mobile application for simple needs(Mini Project)
13	Create an AIDL service that calculates Car Loan EMI.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Develop mobile applications using GUI and Layouts.
CO2	Develop mobile applications using Event Listener.
CO3	Develop mobile applications using Databases.
CO4	Develop mobile applications using RSS feed, Internal/External storage, SMS, Multi-threading and GPS.
CO5	Analyze and discover own mobile app for simple needs.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	-	-	-	2	-	-	2	2	2	2
CO2	3	3	3	3	3	-	-	-	2	-	-	2	3	3	3
CO3	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	3	2	-	-	1	-	-	2	3	2	2
CO5	3	3	3	3	3	2	2	2	2	1	2	3	3	3	3
CO	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**3**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE		**191CS72B / SECURITY LABORATORY**		0	0	2	1

COURSE OBJECTIVES
✓ To learn different cipher techniques ✓ To implement the algorithms DES, RSA,MD5,SHA-1 To use network security tools and vulnerability assessment tools

LIST OF EXPERIMENTS	

1	Perform encryption, decryption using the following substitution techniques
	  i. Ceaser cipher,
	  ii. Play air 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	Calculate the message digest of a text using the SHA-1 algorithm.
8	Implement the SIGNATURE SCHEME - Digital Signature Standard.
9	Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10	Automated Attack and Penetration Tools, Exploring N-Stalker, a Vulnerability Assessment Tool

11	Defeating Malware
	  i) Building Trojans
	  ii) Rootkit Hunter

12	Implementation of MD5 Algorithm
13	Setup a honey pot and monitor the honey pot on Network(KF Sensor)

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Identify the use of programming languages to implement Symmetric cryptography
CO2	Build cryptosystems by applying symmetric and public key encryption algorithms.
CO3	Construct code for authentication algorithms.

CO4	Develop a signature scheme using Digital signature standard.
CO5	Implement the network security system using open source tools.

CO-PO & PSO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	-	2	2	-	-	3	2	2	2
CO2	3	3	3	2	2	2	-	2	2	-	-	3	3	3	2
CO3	3	3	3	2	2	2	-	2	-	-	-	3	3	3	2
CO4	3	3	3	3	2	2	-	2	1	-	-	3	3	2	2
CO5	3	3	3	3	3	2	2	2	2	1	2	3	3	3	3
CO	3	3	3	2	2	2	2	2	2	1	2	3	3	3	2

SEMESTER-VIII

Program Elective -VI (Semester - VIII)

Course Code	Name of the Course	Category	L	T	P	Credits
191IT834	Industrial Economics and Corporate Management	PE	3	0	0	3
191IT833	Enterprise Resource Planning	PE	3	0	0	3
191IT831	Cognitive Computing	PE	3	0	0	3
191HS801	Professional Ethics in Engineering	PE	3	0	0	3
191IT832	Computer Forensics	PE	3	0	0	3
191IT835	Next Generation Networks	PE	3	0	0	3

Program Elective -VI
SEMESTER-VIII

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT834 / INDUSTRIAL ECONOMICS AND CORPORATE MANAGEMENT		3	0	0	3

COURSE OBJECTIVES

➢ To understand economic case study or problem analyze the demand and supply and sketch ademand and supply curve.
➢ To analysis stock market ,identify, and devise investment plan,
➢ To know an inflation rate of India, analyze and specify the causes and provide the solution toeach cause.
➢ To understand job requirement formulate the steps involved in a selection process as a chart andinterpret it.
➢ To determine the Break even and find out the strength and weakness of the Market Structure.

SYLLABUS

UNIT-I	ECONOMICS	9

Definition- Relationship between Economics and Engineering- Demand Analysis and Supply Analysis, Elasticity of Demand and Supply- Cost Of Production- Break-Even Analysis- Pricing Under Perfect Competition, Monopoly and Monopolistic Market.

UNIT-II	INDUSTRIAL FINANCE AND ACCOUNTING	9

Needs for Finance, Types of Finance- Sources of Finance- Business Cycle and Business Policies- Demand Recession in India-Causes, Indicators and Prevention- Stock Exchange.

UNIT-III	MONEY AND EMPLOYMENT	9

Estimation of National Income, Methods and Problems- Inflation and Deflation- Unemployment- Money and Changes in Value of Money, Commercial Banks, Central Banking- New Economic Environment- Privatisation, Liberalisation and Globalisation-Importance of Patent Rights

UNIT-IV	HUMAN RESOURCE MANAGEMENT	9

Principles of Management, Evolution of Management, Development of Managerial Skills- Human Resource Management- Importance- Objectives- Job Analysis- Recruitment- Selection and Placement and Training Development.

UNIT-V	MARKETING AND INSURANCE	9

Marketing -Definition, Aims, Need for Marketing- Marketing Function- Marketing Management and its Functions- Marketing Versus Selling- Concept of Insurance- Life Insurance, Fire Insurance, Marine Insurance.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Analyze the demand and supply and sketch ademand and supply curve.
CO2	Analyze stock market, identify, and devise investment plan.
CO3	Analyze the inflation rate of India, specify the causes and provide the solution to each cause.
CO4	Formulate the steps involved in a selection process as a chart and interpret it.
CO5	Determine the Break even and find out the strength and weakness of the Market Structure.

TEXT BOOKS
1. P.L.Mehta, "Managerial Economics", S.Chand & Co, 2013 (Economics, Industrial Finance and Accounting)   .   C.D.Balaji, "Business Organization and Management", Margham publication, 2015 (IndustrialFinance and Accounting, Human Resource Management and Marketing and Insurance)   3. M.L.Jhingan, "Macro Economic Theory"Vrinda publications (P) Ltd, Twelth Edition 2012 (Money and Employment)

REFERENCES
1. Prasanna Chandra, "Fundamental of financial management "McGraw Hill Education India Pvt ltd 1990   2. Appannaiah, reddy and shanthi, "Economics for Business" Delhi, 2004   3. V.S.Bagad, "Principles of Management", Technical Publication Pune, 2009   4. Philip Kotler, "Marketing Management", Thirteenth Edition, Pearson Education.   5. R.S.N.Pillai and Bagavathi, "Marketing Management", Sultan Chand & Sons, 2009.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		191IT833 / ENTERPRISE RESOURCE PLANNING		3	0	0	3

COURSE OBJECTIVES

- ➢ Describe the operational aspects of ERP system and its related technologies.
- ➢ Demonstrate the steps required for ERP Project management and implementation process by choosing the right vendors/consultants, employee training and monitoring.
- ➢ Categorize the business modules of an ERP package in order to define the functionality ofvarious departments in a company.
- ➢ Analyze the ERP marketplace and its vendors, and assess how Enterprise Application Integration(EAI), e-business help the company use ERP to its utmost benefit.

SYLLABUS

UNIT-I	INTRODUCTION	9

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining -OLAP – SCM.

UNIT-II	ERP IMPLEMENTATION	9

ERP Implementation Lifecycle - Implementation Methodologies - ERP deployment methods - Package Selection – Process Definition - Vendors and Consultants - Contract with Vendors, Consultants and Employees - Training and education- Project Management and Monitoring.

UNIT-III	THE ERP BUSINESS MODULES	9

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance – Materials Management - Quality Management - Sales and Distribution.

UNIT-IV	THE ERP MARKET & ERP	9

ERP Marketplace and Marketplace Dynamics - ERP Vendors - SAP AG, Oracle Corporation, Microsoft Dynamics, EPICOR, QAD, RAMCO Systems - Enterprise Application Integration (EAI)- ERP and E-Business- Future Directions and Trends in ERP.

UNIT-V	SAP	9

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Describe the operational aspects of ERP system and its related technologies.
CO2	Implement ERP project Management process bychoosing the right vendors/consultants, employee training and monitoring.
CO3	Analyze business modules of an ERP package
CO4	Analyze the ERP marketplace and its vendors, and assess how Enterprise Application Integration(EAI), e-business help the company use ERP to its utmost benefit
CO5	Understand SAP and its Architecture.

TEXT BOOKS

1. Alexis Leon," ERP Demystified", Tata McGraw Hill, New Delhi, Third Edition, 2014.
2. Dreamtech Press, "SAP R/3, Black Book", Dreamtech Software Team, 2006 (SAP).

REFERENCES

1. Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2013.
2. Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts andPractice", Prentice Hall of India, New Delhi, Second Edition, 2012.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT831 / COGNITIVE COMPUTING**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- ➢ To know the theoretical background of cognition.
- ➢ To understand the link between cognition and computational intelligence.
- ➢ To explore probabilistic programming language.
- ➢ To study the computational inference models of cognition.
- ➢ To study the computational learning models of cognition

SYLLABUS

UNIT-I	PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE	9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Detour before the naturalistic turn – The Philosophy of Science – The Mind in Cognitive Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Neurosciences: Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT-II	COMPUTATIONAL INTELLIGENCE	9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Decision making under Uncertainty – Learning – Language – Vision – Robotics

UNIT-III	PROBABILISTIC PROGRAMMING LANGUAGE	9

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations – Enumeration – Other basic computation.

UNIT-IV	IMPLEMENTING THE INFERENCE MODELS OF COGNITION	9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference..

UNIT-V	IMPLEMENTING THE LEARNING MODELS OF COGNITION	9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models – Occam's Razor – Learning (Deep) Continuous Functions – Mixture Models.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Understand the underlying theory behind cognition.
CO2	Connect to the cognition elements computationally.
CO3	Implement mathematical functions through WebPPL.
CO4	Develop a cognitive inference and learning model.
CO5	Explore the recent trends in cognitive computing.

TEXT BOOKS

1. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.

REFERENCES

1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of ProbabilisticProgramming Languages", Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Modelsof Cognition", Second Edition, 2016, https://probmods.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		191HS801 / PROFESSIONAL ETHICS INENGINEERING		3	0	0	3

COURSE OBJECTIVES
➢ To enable the students to create an awareness on Engineering Ethics and Human Values,   ➢ To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

SYLLABUS	
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 – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management- Auditing Standards, Statements and Guidance Notes- An overview, Audit Planning, Strategy and Execution.

UNIT-II	**ENGINEERING ETHICS**	**9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT-III	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT-IV	**SAFETY, RESPONSIBILITIES AND RIGHTS**	**9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

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 –Code of Conduct – Corporate Social Responsibility – Case Studies for role morality.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Apply ethics to the society with moral values and ethical theories
CO2	Use the ethical issues related to engineering
CO3	Realize the responsibilities and rights to engineering
CO4	Identify the assessment of safety and risk and respect for authority
CO5	Analyze the global issues in engineering

TEXT BOOKS
1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, NewDelhi, 2003. 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall ofIndia, New Delhi, 2004.

REFERENCES

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.2.Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics –
  Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi,2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists andEngineers", Oxford
  University Press, Oxford, 2001
5.Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social
  Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community SService Centre, " Value Education", Vethathiri publications, Erode,2011

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		**191IT832 / COMPUTER FORENSICS**		3	0	0	3

COURSE OBJECTIVES

- To provide an understanding of computer forensics fundamentals.
- To analyze various computer forensics technologies.
- To identify methods for data recovery.
- To apply the methods for preservation of digital evidence.
- To learn about the types of attacks and remedial actions in the context of systems, networks,images and videos

SYLLABUS

UNIT-I	INCIDENT AND INCIDENT RESPONSE	9

Introduction to Security Threats: Introduction – Computer Crimes – Computer Threats and Intrusions – Phishing – Identity Theft – Cyber Terrorism and Cyber War – Need for Security: Information Security – OS Security – Database Security – Software Development Security – Introduction to Incident – Incident Response Methodology – Steps – Activities in Initial Response Phase After Detection of an Incident.

UNIT-II	FILE STORAGE AND DATA RECOVERY	9

File Systems – FAT, NTFS, NTFS Encrypting File System – Forensic Analysis of File Systems – Storage Fundamentals – Initial Response & Volatile Data Collection from Windows System – Initial Response & Volatile Data Collection from Unix system – Forensic Duplication – Tools – Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events – Networks

UNIT-III	NETWORK AND EMAIL FORENSICS	9

Network Evidence – Types of Network Monitoring – Setting Up a Network Monitoring System – Network Data Analysis – Email Clients – Email Tracing – Internet Fraud – Spam Investigations – Mobile Forensics – Subscriber Identity Module (SIM) Investigations – Wireless Device Investigations – PDA Investigations.

UNIT-IV	SYSTEM FORENSICS	9

Data Analysis: Analysis Methodology – Investigating Live Systems (Windows & Mac OS) – Hacking: Investigating Hacker Tools – Ethical Issues – Cybercrime. Forensic and Investigative tools – Forensic Equipments for evidence collection – Post exploitation.

UNIT-V	IMAGE AND VIDEO FORENSICS	9

Recognizing a Graphics File – Data Compression – Locating and Recovering Graphics Files – Identifying Unknown File Formats – Copyright Issues with Graphics – Fraud using image and video – Detection of Fraud in images and video.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Recognize attacks on systems.
CO2	Design a counter attack incident response and incident response methodology.
CO3	Illustrate the methods for data recovery, evidence collection and data seizure.
CO4	Understand network and email attacks and forensic investigation with tools.
CO5	Use forensic tools and collect evidences of a computer crime. Analyze various image

TEXT BOOKS

1. Kevin Mandia, Jason T. Luttgens, Matthew Pepe, "Incident Response and Computer Forensics", Tata McGraw-Hill, 2014.

REFERENCES

1. Bill Nelson, Amelia Philips, Christopher Steuart, "Guide to Computer Forensics andInvestigations", Cengage Learning, 2018.
2. John R. Vacca, "Computer Forensics", Firewall Media, 2009.
3. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", Auerbach Publications, FirstEdition, 2014.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191IT835 / NEXT GENERATION NETWORKS			3	0	0	3

COURSE OBJECTIVES
➢ To learn the fundamentals of 5G internet.   ➢ To understand the concept of small cells in 5G mobile networks.   ➢ To learn the mobile clouds in 5G network context.   ➢ To understand the role of cognitive radios in 5G networks.   ➢ To learn the security issues in 5G networks.

SYLLABUS		
UNIT-I	PERVASIVE CONNECTED WORLD AND 5G INTERNET	9
Historical Trend of Wireless Communications – Evolution of LTE Technology to Beyond 4G – 5G Roadmap – Ten Pillars of 5G – Internet of Things and Context Awareness – Networking Reconfiguration and Virtualization Support – Mobility – Quality of Service Control – Emerging Approach for Resource over Provisioning.		
UNIT-II	SMALL CELLS FOR 5G MOBILE NETWORKS	9
Introduction to Small Cells – Capacity Limits and Achievable Gains with Densification – Mobile Data Demand – Demand vs. Capacity – Small Cell Challenges.		
UNIT-III	COOPERATION FOR NEXT GENERATION WIRELESS NETWORKS	9
Introduction – Cooperative Diversity and Relaying Strategies: Cooperation and Network Coding, Cooperative ARQ MAC Protocols – PHY Layer Impact on MAC Protocol Analysis: Impact of Fast Fading and Shadowing on Packet Reception for QoS Guarantee, Impact of Shadowing Spatial Correlation – Study: NCCARQ, PHY Layer Impact.		
UNIT-IV	MOBILE CLOUDS AND COGNITIVE RADIO	9
Introduction – The Mobile Cloud – Mobile Cloud Enablers – Network Coding – Overview of Cognitive Radio Technology in 5G Wireless – Spectrum Optimization using Cognitive Radio – Relevant Spectrum Optimization Literature in 5G – Cognitive Radio and Carrier Aggregation – Energy Efficient Cognitive Radio Technology.		
UNIT-V	SECURITY AND SELF ORGANISING NETWORKS	9
Cr Overview of Potential 5G Communications System Architecture – Security Issues and Challenges in 5G Communications Systems – Self Organising Networks: Introduction, Self Organising Networks in UMTS and LTE, The Need for Self Organising Networks in 5G, Evolution towards Small Cell Dominant HetNets.		

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Compare the 5G network with older generations of networks.
CO2	Identify suitable small cells for different applications in 5G networks.
CO3	Simulate 5G network scenarios.
CO4	Connect applications to mobile cloud.
CO5	Design applications with 5G network support. Analyze the security risks in 5G networks.

TEXT BOOKS

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.

REFERENCES

1. Yin Zhang, Min Chen, "Cloud Based 5G Wireless Networks – Springer Briefs in ComputerScience", Springer, 2016.
2. Athanasios G. Kanatas, Konstantina S. Nikita, Panagiotis (Takis) Mathiopoulos, "New Directions in Wireless Communications Systems: From Mobile to 5G", CRC Press, 2017.

OPEN ELECTIVE

OPEN ELECTIVE-I

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191CE542	Air Pollution and Control Engineering	OE	3	0	0	3
2	191EE541	Basics of Electric Power Generation	OE	3	0	0	3
3	191ME542	Design Thinking	OE	3	0	0	3
4	191CE544	Foundational Course in Entrepreneurship	OE	3	0	0	3
5	191EC544	Medical Electronics	OE	3	0	0	3
6	191BM545	Principles Of Telemedicine	OE	3	0	0	3

OPEN ELECTIVE-II

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191CE541	Advanced Course in Entrepreneurship	OE	3	0	0	3
2	191BM541	Basic Of Bioinformatics	OE	3	0	0	3
3	191EE543	Electrical Machines and Applications	OE	3	0	0	3
4	191ME543	Energy Conservation and Management	OE	3	0	0	3
5	191BM543	Introduction To Biomedical Devices	OE	3	0	0	3
6	191EC541	Robotics and Automation	OE	3	0	0	3

OPEN ELECTIVE-III

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191BM544	Introduction To Human Anatomy Systems	OE	3	0	0	3
2	191EE546	Introduction to Smart Grid	OE	3	0	0	3
3	191ME546	Renewable Energy Sources	OE	3	0	0	3
4	191EC548	Satellite Communication	OE	3	0	0	3
5	191EC5410	Telecommunication Network Management	OE	3	0	0	3
6	191CE5411	Traffic Engineering and Management	OE	3	0	0	3

OPEN ELECTIVE-IV

S.No	Course Code	Name of the Course	Category	No of Hours/Week			C
THEORY				L	T	P	
1	191EC541	Cognitive Radio	OE	3	0	0	3
2	191BM542	Electronics In Medicine	OE	3	0	0	3
3	191ME544	Lean Six Sigma	OE	3	0	0	3
4	191CE548	Municipal Solid Waste Management	OE	3	0	0	3
5	191EE548	Power Electronics and Applications	OE	3	0	0	3
6	191EC546	Speech Signal Processing	OE	3	0	0	3

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191CE544/ Foundational Course in Entrepreneurship		3	0	0	3

COURSE OBJECTIVES

- Empower students with entrepreneurial mindset and business skills leading to superior job prospects, entrepreneurship and long term entrepreneurship.
- Support aspiring entrepreneurs with validated ideas to start meaningful ventures by connecting them to entrepreneurial ecosystems and customized learning programs.
- Develop an entrepreneurial outlook and mindset, critical skills and knowledge.

SYLLABUS

UNIT-I	SELF-DISCOVERY	9

Find your flow-Effectuation Principles -Case Study-Identify your Entrepreneurial Style- Venture and Team formation Strategy-Shared Leadership-Hiring& Fitment-Team Role and Responsibilities.

UNIT-II	OPPORTUNITY DISCOVERY	12

Identifying problems worth solving-Design Thinking-Look for Solutions-Identify personalized idea for startup - Venture start up Strategy.

UNIT-III	CUSTOMER AND SOLUTION	8

Customers and Markets-Identify your customer segment and Niche-Identify jobs, pains, gains and early adopters-Value Proposition-Outcome driven innovation-Basics of business regulation

UNIT-IV	BUSINESS MODEL AND SALES MARKETING	8

Basis of business model and lean approach-Lean Canvas-Risks and Assumptions-strategic pitching of business model-Positioning and Branding-Channels-Sales Planning-Selling Skills

UNIT-V	VALIDATION AND MONEY	8

Blue ocean strategy-Problem and Solution fit-Product& Market fit-Revenue and Pricing-Profitability checks-Bootstrapping and Initial Financing-Practice pitching-Case Study

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Empower students with entrepreneurial mindset and business skills
CO2	Making students to get exposed to superior job prospects,entrepreneurship and long term entrepreneurship.
CO3	Support aspiring entrepreneurs with validated ideas to start meaningful ventures
CO4	Connecting students to connecting them toentrepreneurial ecosystems and customized learning programs.
CO5	Develop an entrepreneurial outlook and mindset, critical skills and knowledge.

TEXT BOOKS
1. Khanka S.S."Entrepreneural Develoment' S.Chand & Co.Ltd.New Delhi 2013.   2. Donald F Kuratko,"Entrpreneurship -Theory,Process and practice", 9th Edition,Cengage Learning, 2014.

REFERENCES
1. Hisrich R D,Peters M.P.,'Entreprenurship' 8th Edition, tata McGraw-Hill,201   2. Rajeev Roy,'Entrepreneurship', II Edition, Oxford University Press,2011.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191CE5411/ TRAFFIC ENGINEERING AND MANAGEMENT		3	0	0	3
COURSE OBJECTIVES							

- To give an overview of Traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.

SYLLABUS	
UNIT-I TRAFFIC PLANNING AND CHARACTERISTICS	**9**
Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town ,country ,regional and all urban infrastructure – Towards Sustainable approach. – land use & transport and modal integration.	
UNIT-II TRAFFIC SURVEYS	**12**
Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non- motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.	
UNIT-III TRAFFIC DESIGN AND VISUAL AIDS	**8**
Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.	
UNIT-IV TRAFFIC SAFETY AND ENVIRONMENT	**8**
Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.	
UNIT-V TRAFFIC MANAGEMENT	**8**
Area Traffic Management System - Traffic System Management (TSM) with IRC standards –Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods– Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.	

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analysis traffic problems and plan for traffic systems various uses.
CO2	Design Channels, Intersections, signals and parking arrangements.
CO3	Design visual Aids for traffic.
CO4	Understand Traffic safety and Environment.
CO5	Develop Traffic management Systems.

TEXT BOOKS
1. Kadiyali, L.R, "Traffic Engineering and Transport Planning", KhannaPublishers, Delhi, 2013
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
3. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

REFERENCES
1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996
5. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005
6. Taylor MAP and Young W, "Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.

YEAR		III	SEMESTER		V	L	T	P	C
COURSE CODE / COURSE TITLE		191CE542/ AIR POLLUTION AND CONTROL ENGINEERING				3	0	0	3

COURSE OBJECTIVES
• To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

SYLLABUS		
UNIT-I	**INTRODUCTION**	**7**
Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards –Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.		
UNIT-II	**METEOROLOGY**	**6**
Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.		
UNIT-III	**CONTROL OF PARTICULATE CONTAMINANTS**	**11**
Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.		
UNIT-IV	**CONTROL OF GASEOUS CONTAMINANTS**	**11**
Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring – Operational Considerations.		
UNIT-V	**INDOOR AIR QUALITY MANAGEMENT**	**10**
Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
CO2	Ability to identify, formulate and solve air and noise pollution problems
CO3	Ability to design stacks and particulate air pollution control devices to meet applicable standards
CO4	Ability to select control equipment.
CO5	Ability to ensure quality, control and preventive measures.

TEXT BOOKS

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, Springer Science + Science Media LLC, 2004.

2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017.

3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCES

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.

2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.

3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.

4. M.N Rao and HVN Rao, "Air Pollution",Tata Mcgraw Hill Publishing Company limited,2007.

5. C.S.Rao, "Environmental Pollution Control Engineering", New Age International (P) Limited Publishers, 2006.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191BM544/ INTRODUCTION TO HUMAN ANATOMY SYSTEMS		3	0	0	3

COURSE OBJECTIVES

- Students will have clear knowledge of anatomy and physiology of every vital organ.

SYLLABUS

UNIT-I	Cell	9

Structure and organelles - Functions of each component in the cell. Different types of cells. Cellmembrane – transport across membrane – origin of cell membrane potential – Action potential components.Structureof a Neuron.Classification of neurons.Parts of brain cortical localization of functions. Conduction of action potential in neuron - synaptic transmission. Parts of spinalcord, simplereflex, with drawl reflex and autonomic nervous system.

UNIT-II	Blood	9

Composition –functions of blood -RBCstructure-production of RBC.WBCtypes–productionsof WBC cells and their functions. Blood groups –importance of blood groups –identification of blood groups. Platelet production and its functions.

UNIT-III	Digestive system	9

Digestive system parts (oral cavity, stomach, intestine, large intestine and accessory glands).Digestionandabsorptionofcarbohydrates,lipidsandproteins.StructureofKidneyandnephron.Blood supply to Kidney. Mechanism of urine formation. Structure of eye and ear, auditory andvisualpathways.

UNIT-IV	Bones and muscle	9

Orientation of body planes. Classification of bones and types of joints. Types of muscles:skeletal, cardiac and smooth muscle structure and their differences. Motor unit - Structure of neuro muscular junction.Excitation moto rneuron and skeletal muscle contraction(change in potential - mechanical – energy changes- thermal – pH changes.) Effect of second stimulus-fasciculation– fibrillation-EMG

UNIT-V	Respiratory system	9

Parts of respiratory system (Trachea, Bronchi, muscle of respiration, thoracic cage, pleuralmembranes). Mechanics of respiration - Volumes and capacities of lung. Carbon dioxide andoxygentransport.Typesofhypoxia.Regulationofrespiration.Structureofheart-Cardiac cycle
–ECG-Heart sound-volume and pressurechanges

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Explain basic structure and functions of cell
CO2	Summarize the functioning and components of blood and identification of systems
CO3	Explain interconnect of various systems
CO4	Describe skeletal and muscular system
CO5	Describe about anatomy and physiology of various systems of human body

TEXT BOOKS
1.Elaine.N. Marieb, 'Essentials of Human Anatomy and Physiology', 8th edition, PearsonEducation,NewDelhi ,2007.

REFERENCES
1.WilliamF.Ganong,'ReviewofMedicalPhysiology',22nd edition,McGrawHill,NewDelhi,2005. 2.A.K. Jain, 'Text book of Physiology', volume I and II, Third edition, Avichal Publishing company, NewDelhi, 2005.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191BM543/ INTRODUCTION TO BIOMEDICAL DEVICES		3	0	0	3

COURSE OBJECTIVES

- To study the basic characteristics of measurement system.
- The students will be exposed to electrical and non-electrical physiological measurements and bio-amplifiers.

SYLLABUS

UNIT-I	TRANSDUCERS	9

Characteristics- Static, Dynamic, Errors in the measurements, Classification of transducers - Resistive, Capacitive, Inductive, Photoelectric, piezoelectric and mechano electronics.

UNIT-II	ELECTRODES & AMPLIFIERS	9

Types of electrodes Half cell potential, Reference electrodes, polarization effects, Polarisable and nonpolarisable electrodes, Micro electrodes, Equivalent Circuits, Signal Conditioning circuits- Characteristics of Amplifiers , Differential Amplifiers, Filters, Bridge circuits, A/D Converters. surface, needle and micro electrodes and their equivalent circuits.

UNIT-III	CHEMICAL AND OPTICAL TRANSDUCERS	9

Biochemical sensors - PH, PO2 electrodes, Ion sensor, An-ion and Cat-ion sensor, Liquid and solid ion exchange membrane electrode, Enzyme electrode, Principle of fiber optic cable, fiber optic sensors.

UNIT-IV	BIO-CHEMICAL MEASUREMENT	9

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter.

UNIT-V	RECORDERS AND DISPLAY	9

Types of recorders, Ink jet, heated stylus, Photographic recorder, Multicolor dot scanners, CRO, storage type, long persistence, digital scope, magnetic tape recorders.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Measure various electrical parameters with accuracy, precision, resolution.
CO2	Elucidate the origin of bio potentials and various bio electrodes.
CO3	Select appropriate light sensors for measurement of physical phenomenon.
CO4	Develop measurement systems for non-electrical parameter measurements.
CO5	Employ CRO and different types of recorders for appropriate measurement.

TEXT BOOKS
1. Khandpur R.S, "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw-HillNew Delhi, 2014 2. Leslie Cromwell, "Biomedical Instrumentation and measurement", 2nd edition, Prentice hallof India, New Delhi, 2015.

REFERENCES
1. Rangan C.S., Sarma G.R., and Mani V.S.V., Instrumentation devices and system, Tata McGraw hill Publishing Company limited, New Delhi, 1983. 2. John G.Webster, Medical Instrumentation, Application and Design, Third Edition, John willey and sons,1999. 3. Jacob Kline., Handbook of Bio Medical Engineering, Academic press Inc., Sandiego, 1988. 4. J.B.Gupta, A course in electronic and electrical measurement and instrumentation, S.K.Kataria& Sons, 1999. 5. Tatsuo Togawa, Toshiyo Tamura, P.Ake Oberg, Biomedical Transducers and Instruments,CRC Press, New York, 1997. 6. Joseph J.Carr and John M Brown, Introduction To Biomedical Equipment Technology, 4/E,pearson education India.2001.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		191CE548/ MUNICIPAL SOLID WASTE MANAGEMENT		3	0	0	3

COURSE OBJECTIVES

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

SYLLABUS	

UNIT-I	SOURCES AND CHARACTERISTICS	9

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) –- Role of public and NGO"s- Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT-II	SOURCE REDUCTION , WASTE STORAGE AND RECYCLING	8

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – On- site storage methods – Effect of storage, materials used for containers – segregation of solid wastes– Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics and Construction/Demolition wastes.

UNIT-III	COLLECTION AND TRANSFER OF WASTES	8

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

UNIT-IV	PROCESSING OF WASTES	12

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT-V	WASTE DISPOSAL	8

Land disposal of solid waste- Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation

	COURSE OUTCOMES On completion of the course, students will be able to
CO1	Understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
CO2	Reduction, reuse and recycling of waste.
CO3	Ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.
CO4	Understand the operations of sanitary land fill.
CO5	Acquire knowledge on the issues on solid waste management from an integrated and holistic perspective, as wellas in the local and international context.

TEXT BOOKS
1. William A. Worrell, P. Aarne Vesilind, "Solid Waste Engineering", Cengage Learning, 2012.
2. John Pitchel, "Waste Management Practices-Municipal, Hazardous and industrial" CRC Press,Taylor and Francis, New York, 2014.

REFERENCES
1. CPHEEO, "Manual on Municipal Solid Waste Management", Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2014.   2 George Tchobanoglous and Frank Kreith, Handbook of Solid waste management, McGraw Hill, New York, 2002

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191BM541/ Basics of Bio informatics		3	0	0	3

COURSE OBJECTIVES
• To understand the genesis of bioinformatics, comparison with its allied disciplines and data bases.   • Know about the data processing and methods of analysis.   • The students are exposed to the applications and software of bioinformatics.

SYLLABUS	

UNIT-I	INTRODUCTION	9

Introduction to bioinformatics, biological information, the Central Dogma, Bioinformatics: Definition and overview Bioinformatics, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Genome projects, human genome project- Databases and human chromosomes, role of Bioinformatics in biological sequences. Biological data- DNA sequence protein sequence, macro molecular structure. Challenges in bioinformatics.

UNIT-II	DATABASES	9

Identifying problems worth solving-Design Thinking-Look for Solutions-Identify personalized idea for startup - Venture start up Strategy.

UNIT-III	DATAPROCESSING	9

Data–Access, Retrieval and Submission: Standard search engines; Data retrieval tools– Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches:Local versus global. Distancemetrics. Similarity and homology. Scoringmatrices.

UNIT-IV	METHODS OF ANALYSIS	9

Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, and PSIBLAST.Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment;

UNIT-V	APPLICATIONS AND SOFTWARES	9

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis:Comparative genomics, orthologs, paralogs. Genome analysis – Genome annotation Basic software tools used in bioinformatics - Sequence analysis- GCG, Emboss - Cn3D viewer- Rasmol, Swiss pdb viewer, Pymol, Jmol.Modeling-Discovery studio2.0,Docking –Auto dock,HEX.

	COURSE OUTCOMES On completion of the course, students will be able to
CO1	Elucidate the genesis of bioinformatics, comparison with its allied disciplines.
CO2	Explain primary sequence databases, prone in sequence and structure databases, Organism specific databases
CO3	Elucidate the processing of acquired data
CO4	Describe various Methods of sequence alignment
CO5	Explain applications of bio informatics in the area of biological and biomedical sciences

REFERENCES
1. IntroductiontoBioinformaticsbyArthurK.Lesk, OxfordUniversityPress.
2. AlgorithmsonStrings,TreesandSequencesbyDanGusfield,CambridgeUniversityPress.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin,S.Eddy, A.Krogh,G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring HarborLaboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall,O'Reilley Media

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191BM545/ PRINCIPLES OF TELEMEDICINE		3	0	0	3

COURSE OBJECTIVES
- Know Scope, Benefits and Limitations of Telemedicine.   - Know Security and Standards and their use in Telemedicine Applications

SYLLABUS	
UNIT-I	HISTORY AND FUNDAMENTALS OF TELEMEDICINE	9

History and Evolution of telemedicine, definition of telemedicine, Functional diagram of telemedicine system, Telemedicine, Tele health, Tele care, benefits & limitations of telemedicine, Introduction of Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues.

UNIT-II	TYPES OF COMMUNICATION	9

Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications: GSM, satellite and Micro Wave. Types of information: Audio, Video, still Images, text and data, Fax.

UNIT-III	DATA EXCHANGES	9

Network Configuration, Circuit and packet switching, H.320 series (Video phone based ISBN) T.120, h.324 (Video phone based PSTN), Video Conferencing.

UNIT-IV	DATA SECURITY AND STANDARD	9

Encryption, Cryptography, Mechanisms of encryption, Phases of Encryption. Photocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7. Ethical and legal aspects of Telemedicine: Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment.

UNIT-V	APPLICATIONS OF TELEMEDICINE	9

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e- Health care, Telemedicine in neurosciences.

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Apply ethical and legal aspects of Telemedicine in Telehealth and Telecare.
CO2	Identify the fundamentals of the many forms of telemedicine communication
CO3	Choose the various multimedia conferencing standards for data exchanges
CO4	Make use of data security standards and protocols behind encryption techniques for secure transmission of data in telemedicine
CO5	Apply telemedicine's multimedia technology in the medical field

TEXTBOOKS
1.A.C.Norris, Essentials of Telemedicine and Telecare, John Wiley & Sons, 2002.

REFERENCES
1. Olga Ferrer-Roca, M.SosaLudicissa, Handbook of Telemedicine, IOS press 2002.

YEAR		SEMESTER		L	T	P	C
COURSE CODE / COURSE TITLE		**191BM542/ ELECTRONICS IN MEDICINE**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES
At the end of the course the students will have clear knowledge of electronics in medicine inmedical field

SYLLABUS		
UNIT-I	**BASICSOFELECTRONICSINMEDICINE**	**9**
Fields of Application - Designing Electronics in Medicine-Medical Electronics Specific Requirements-ElectronicSensing-HealthConditionMonitoring-BiosignalsandTransducers		
UNIT-II	**ELECTRONICSFORWIRELESSHEALTHMONITORING**	**9**
Requirements for Wireless Devices -Data Acquisition-System Integration-Wireless Communications		
UNIT-III	**POWERSUPPLY**	**9**
Battery Power Budget Considerations- Wireless Power- Wireless Power Link Analysis-Wireless PowerCharger-Energy Harvesting		
UNIT-IV	**WEARABLEMEDICALELECTRONICS**	**9**
Wearable Systems- Categories of Wearable Systems-Design Requirements- Sensors for Wearable Systems-Sensing Methodologies		
UNIT-V	**ELECTRONICSIN MEDICINEATWORK**	**9**
Wireless and Wearable Low-Power-Health Monitoring Systems-Sensors-Wireless Link-Optical Bio potential Recording- Optical Electrodes -Optical Signal Acquisition –Localization Solutions-Ambient AssistedLiving Applications-Wireless Link Design for Biomedical Applications.		

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Describe the basics of electronics in medicine.
CO2	Describe the wireless electronics used in healthcare
CO3	Explain the power supplies of electronics in medicine
CO4	Explain the basis of wearable devices
CO5	Use smart systems to monitor vital parameters

TEXTBOOKS

1 J.C.Schuh:Medicaldeviceregulationsandtestingfortoxicologicpathologists,Toxicol.Pathol.**36**,63–69(2008)

REFERENCES

1.D.Lapedes:*McGraw-HillDictionaryofScientificandTechnicalTerms*(McGraw-Hill,NewYork2000)

SEMESTER	V	L	T	P	C
COURSE CODE/ TITLE	**191EC541/ COGNITIVE RADIO**	**3**	**0**	**0**	**3**
	COURSE OBJECTIVES				

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
- To study the basic architecture and standard for cognitive radio
- To understand the physical, MAC and Network layer design of cognitive radio
- To expose the student to evolving applications and advanced features of cognitiveradio

UNIT-I	**INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO**	**9**

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT-II	**COGNITIVE RADIO ARCHITECTURE**	**9**

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT-III	**SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS**	**9**

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

UNIT-IV	**MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO**	**9**

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT-V	**ADVANCED TOPICS IN COGNITIVE RADIO**	**9**

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
CO2	Gain knowledge on the design principles on software defined radio and cognitive radio
CO3	Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access
CO4	Understand the physical, MAC and Network layer design of cognitive radio
CO5	Apply the knowledge of advanced features of cognitive radio for real world applications

TEXT BOOKS
1. Alexander M. Wyglinski, MaziarNekovee, Thomas Hou, ―Cognitive Radio Communications and Networks, Academic Press, Elsevier, 2010. (Unit I to IV)   2. Huseyin Arslan (Ed.), ―Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007. (Unit V)
REFERENCES
1. Bruce Fette,―Cognitive Radio Technologyǁ,Newnes,2006.   2. Kwang-Cheng Chen, Ramjee Prasad, ― Cognitive Radio Networks, John Wiley and Sons, 2009.   3. EzioBiglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B.Mandayam, H.Vincent Poor,Principles of Cognitive Radio, Cambridge University Press,2012.

SEMESTER	V	L	T	P	C
COURSE CODE/ TITLE	**191EC544/MEDICAL ELECTRONICS**	**3**	**0**	**0**	**3**
OBJECTIVES	- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters - To study about the various assist devices used in the hospitals - To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.				
UNIT-I	**ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING**		**9**		
Sources of bio medical signals, Bio-potentials, Bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics					
UNIT-II	**BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT**		**9**		
pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.					
UNIT-III	**ASSIST DEVICES**		**9**		
Cardiac pacemakers, DC Defibrillator, Dialyzer, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.					
UNIT-IV	**PHYSICAL MEDICINE AND BIOTELEMETRY**		**9**		
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.					
UNIT-V	**RECENT TRENDS IN MEDICAL INSTRUMENTATION**		**9**		
Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.					
OUTCOMES	**On successful completion of this course, the student should be able to:** - Know the human body electro- physiological parameters and recording of bio-potentials - Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc. - Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators - Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods - Know about recent trends in medical instrumentation				
TEXT BOOKS					
1 Leslie Cromwell, -Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi, 2007. (UNIT I – V)					
REFERENCES					
1. Khandpur, R.S., ―Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New Delhi, 2003. 2. John G.Webster, ―Medical Instrumentation Application and Design, 3rd Edition, Wiley India Edition, 2007 3. Joseph J.Carr and John M.Brown, ―Introduction to Biomedical Equipment Technology, John Wiley and Sons, New York, 2004.					

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Know the human body electro- physiological parameters and recording of bio-potentials
CO2	Comprehend the non-electrical physiological parameters and their measurement –body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
CO3	Interpret the various assist devices used in the hospitals viz. pacemakers,defibrillators, dialyzers and ventilators
CO4	Comprehend physical medicine methods eg. ultrasonic, shortwave, microwavesurgical diathermies , and bio-telemetry principles and methods
CO5	Know about recent trends in medical instrumentation

TEXT BOOKS
1 Leslie Cromwell, -Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi, 2007. (UNIT I – V)
REFERENCES
1.Khandpur, R.S., ―Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New Delhi, 2003. 2.John G.Webster, ―Medical Instrumentation Application and Design, 3rd Edition, Wiley India Edition,2007 3.Joseph J.Carr and John M.Brown, ―Introduction to Biomedical Equipment Technology, John Wiley andSons, New York, 2004.

SEMESTER	V	L	T	P	C
COURSE CODE/ TITLE	**191EC546/SPEECH SIGNAL PROCESSING**	3	0	0	3
OBJECTIVES	• 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.				

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 and Implementation issues.

UNIT-IV	SPEECH RECOGNITION				9

Large Vocabulary Continuous Speech Recognition: Architecture of 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.

OUTCOMES	Upon completion of the course, students 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.

TEXT BOOKS

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.

REFERENCES

1. Steven W. Smith, "The Scientist and Engineer"s Guide to Digital Signal Processing", California TechnicalPublishing, 1997.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice" , Pearson Education, 2004.
3. Claudio Becchetti and LucioPrinaRicotti, "Speech Recognition", John Wiley and Sons, 1999.
4. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech andMusic", Wiley- India Edition, 2006.

SEMESTER	V	L	T	P	C
COURSE CODE/ TITLE	**191EC541/ ROBOTICS AND AUTOMATION**	3	0	0	3
OBJECTIVES	• To understand the basic concepts associated with the design, functioning, applications and social aspects of robots • To study about the electrical drive systems and sensors used in robotics for various applications • To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator andend-effector • To learn about various motion planning techniques and the associated control architecture • To understand the implications of AI and other trending concepts of robotics				
UNIT-I	**FOUNDATION FOR BEGINNERS**	9			
	Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator				
UNIT-II	**BUILDING BLOCKS OF A ROBOT**	9			
	Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self-driving cars				
UNIT-III	**KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS**	9			
	Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study.				
UNIT-IV	**NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE**	9			
	Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behavior based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot.				
UNIT-V	**AI AND OTHER RESEARCH TRENDS IN ROBOTICS**	9			
	Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro &Nano robots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids				
OUTCOMES	• Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots &automation • Examine different sensors and actuators for applications like maze solving and self-driving cars. • Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots. • Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning. • Describe the impact and progress in AI and other research trends in the field of robotics.				

TEXT BOOKS
1.Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations,2002   2.Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press,2011
REFERENCES
1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989   2. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, Addison-Wesley, 1989.   3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence,McGraw-Hill, 1987.   4. Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988.   5. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000   6. Ronald C. Arkin, Behavior-based Robotics, MIT Press, 1998   7. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2005   8. Stefano Nolfi, Dario Floreano, Evolutionary Robotics – The Biology, Intelligence and Technology of Self–Organizing Machines (Intelligent Robotics and Autonomous Agents series), MIT Press, 2004.

SEMESTER	V	L	T	P	C
COURSE CODE/ TITLE	**191EC548/SATELLITE COMMUNICATION**	**3**	**0**	**0**	**3**
Objectives	• Understand the basics of satellite orbits • Understand the satellite segment and earth segment • Analyze the various methods of satellite access • Understand the applications of satellites • Understand the basics of satellite Networks				
UNIT-I	**SATELLITE ORBITS**			**9**	
	Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.				
UNIT-II	**SPACE SEGMENT**			**9**	
	Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.				
Unit-III	**SATELLITE LINK DESIGN**			**9**	
	Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.				
UNIT IV	**SATELLITE ACCESS AND CODING METHODS**			**9**	
	Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.				
UNIT-V	**SATELLITE APPLICATIONS**			**9**	
	INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).				
OUTCOMES	Upon completion of the course, students should able to: • Analyze the satellite orbits • Analyze the earth segment and space segment • Analyze the satellite Link design • Understand the basics of satellite Networks • Design various satellite applications				
TEXT BOOKS					
	1. Dennis Roddy,-Satellite Communication‖, 4thEdition,McGrawHill International,2006. 2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication‖,2nd Edition, WileyPublications,2002				

REFERENCES

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, -Satellite Communication Systems Engineering, Prentice Hall/Pearson, 2007.
2. N.Agarwal,"Design of Geo synchronous Space Craft",PrenticeHall,1986.
3. Bruce R. Elbert, -The Satellite Communication Applications, Hand Book, Artech House Bostan London, 1997.
4. TriT.Ha,-Digital Satellite Communication,IIndedition,1990.
5. Emanuel Fthenakis, -Manual of Satellite Communications, McGrawHillBook Co.,1984.
6. Robert G. Winch, -Telecommunication Trans Mission Systems, McGraw-Hill Book Co., 1983.

SEMESTER	V		L	T	P	C
COURSE CODE/ TITLE	**191EC5410/ TELECOMMUNICATION NETWORK MANAGEMENT**		**3**	**0**	**0**	**3**
Objectives	- To understand the concept of network management standards. - To design the common management information service element model. - To understand the various concept of information modelling. - To analyze the concept of SNMPv1 and SNMPv2 protocol. - To analyze the concept of examples of network management.					

UNIT-I	**FOUNDATIONS**	**9**

Network management standards–network management model– organization model– information model abstract syntax notation 1 (ASN.1) – encoding structure– macros–functional model. Network management application functional requirements: Configuration management– fault management–performance management–Error correlation technology– security management–accounting management– common management–report management– polity based management–service level management–management service–community definitions– capturing the requirements– simple and formal approaches–semi formal and formal notations.

UNIT-II	**COMMON MANAGEMENT INFORMATION SERVICE ELEMENT**	**9**

CMISE model–service definitions–errors–scooping and filtering features– synchronization–functional units–association services– common management information protocol specification.

UNIT-III	**INFORMATION MODELING FOR TMN**	**9**

Rationale for information modeling–management information model–object oriented modeling paradigm–structure of management information–managed object class definition–management information base.

UNIT IV	**SIMPLE NETWORK MANAGEMENT PROTOCOL**	**9**

SNMPv1: managed networks–SNMP models– organization model–information model–SNMPv2 communication model–functional model–major changes in SNMPv2–structure of management information, MIB–SNMPv2 protocol– compatibility with SNMPv1– SNMPv3– architecture–applications–MIB security, remote monitoring–SMI and MIB– RMQN1 and RMON2.

UNIT-V	**NETWORK MANAGEMENT EXAMPLES**	**9**

ATM integrated local management interface–ATM MIB–M1– M2–M3– M4– interfaces–ATM digital exchange interface management–digita1 subscriber loop and asymmetric DSL technologies–ADSL configuration management–performance management Network management tools: Network statistics management–network management system–management platform case studies: OPENVIEW–ALMAP.

OUTCOMES	Upon completion of the course, students should able to: - Design and analyze of fault management. - Analyze the common management information protocol specifications. - Design and analyze of management information model. - Design the simple network management protocol. - Design the various types of network management tools.

TEXT BOOKS
1. Mani Subramanian, "Network Management: Principles and Practice" Pearson Education, Second edition, 2010 2. Lakshmi G Raman, "Fundamentals of Telecommunications Network Management" ,Wiley, 1999
REFERENCES
1. Henry Haojin Wang, "Telecommunication Network Management", Mc- Graw Hill ,1999 2. Salah Aidarous & Thomas Plevyak, "Telecommunication Network Management: Technologies and Implementations" , Wiley,1997

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191EE541/ BASICS OF ELECTRIC POWER GENERATION		3	0	0	3

COURSE OBJECTIVES

- To provide the knowledge about the electrical power generation
- To know about various conventional energy sources
- To find out the cost of Electrical Energy

SYLLABUS

UNIT-I	INTRODUCTION	9
	Electric power generation scenario in INDIA from Conventional and non conventional sources of energy. Advantages and disadvantages with conventional and non-conventional energy sources.	
UNIT-II	STEAM POWER STATION	9
	Schematic arrangement, selection of site, Environmental aspects for selecting the sites and locations of thermal power stations, advantages and disadvantages	
UNIT-III	HYDRO POWER STATION	9
	Schematic arrangement, choice of site selection of hydro power, Environmental aspects advantages and disadvantages	
UNIT-IV	NUCLEAR POWER STATION	9
	Schematic arrangement, choice of site selection of Nuclear power station, Environmental aspects advantages and disadvantages	
UNIT-V	TARIFF	9
	Electrical energy calculation in units, Cost of electrical energy, load factor and demand factor, tariff method-flat rate, block rate, two parts.	

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Describe sources of energy and types of power plants.
CO2	Enumerate the factors effecting choice of thermal ,hydal and nuclear power generation.
CO3	Illustrate the advantages and disadvantages of thermal ,hydel and nuclear power generation.
CO4	Illustrate the advantages and disadvantages of nuclear power generation.
CO5	Estimate the cost of electrical energy consumed.

TEXTBOOKS

1. M.L.Soni,P.V Gupta,U.S Bhatnagar and A.Chakraborti "A text book on Power System Engineering" Dhanpat Rai & Co.Pvt.Ltd.1999.

2. V.K Mehta and Rohit Mehta "Principles of Power Systems" S.Chand & company LTD, New Delhi2004.

REFERENCES

1. S.N.Singh "Electrical Power Generation, Transmission and Distribution",PHI, 2003.
2. GD Rai "Non Conventional Energy Sources "Khanna Publishers, 4th edition 2000.
3. Dr. S.L. Uppal," Electrical Power", Khanna Publishers

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		**191EE543/ Electrical Machines and Applications**		3	0	0	3

COURSE OBJECTIVES
• To know various types of electrical machines • To learn about various types of characteristics of electric machines • To find out suitable electric machines for specific applications

SYLLABUS		
UNIT-I	**DC MOTORS**	**9**
	Construction & operating principle, types of DC motors, PMDC motors, back-EMF and its importance, torque production, characteristics, various losses & performance estimation, speedcontrol, applications	
UNIT-II	**TRANSFORMERS**	**9**
	Construction & operating principle-single phase and three phase, types of transformer, turn- ratio, equivalent circuit, various losses & performance estimation, parallel operation, applications	
UNIT-III	**INDUCTION MOTORS**	**9**
	Construction & operating principle of three phase machines, types of induction motors, torqueproduction, torque-slip characteristic, equivalent circuit representation, various losses & performance estimation, speed control, single phase ac motors, universal motors and applications	
UNIT-IV	**PERMANENT MAGNET BRUSHLESS DC (PMBLDC) MOTORS**	**9**
	Construction and operating principle, torque and EMF equations, torque/speed characteristic: performance and efficiency,controllers for PMBLDC motors, applications	
UNIT-V	**STEPPER AND SERVO MOTORS**	**9**
	Basics of stepper motor, construction, working and characteristics of variable reluctance (VR) stepper motors, micro stepping control of stepper motor, construction and working of multistack VR stepper motor, construction and working of permanent magnet (PM) stepper motor, construction and working of hybrid stepper motor, servo motor types, construction and operation of servo motors, servo motor controllers, applications	

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze constructional aspects and operational aspects of electric machines
CO2	Evaluate performance parameters of electric machines
CO3	Adopt suitable control methods for operating electric machines
CO4	Select appropriate electric machines based on constructional & operational characteristics
CO5	Understand the construction and working of Stepper Motor and Servo Motors

TEXTBOOKS

1. A. E. Fitzerald, Charles Kingsley and Stephen D Umans, "Electric Machinery", TMH Publication,2017
2. B.L.Theraja, A.K. Theraja, "A Textbook of Electrical Technology"- Volume-II, S. Chand & Co,2015
3. P. S. Bhimbra, Electrical Machinery, Dhanpatrai Publishers, 2016.

REFERENCES

1. Miller T. J. E., "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, 1985.
2. V. V. Athani, "Stepper Motors: Fundamentals, Applications and Design", New Age International Pvt. Ltd, 1997.
3. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley and Sons,2013
4. Y. Dote and S. Kinoshita, Brushless Servomotors-Fundamentals and Applications, Clarendon Press,Oxford, 1990.

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191EE546/ Introduction to Smart Grid		3	0	0	3

COURSE OBJECTIVES
• To gain insights about the importance of lean manufacturing and six sigma practices

SYLLABUS		
UNIT-I	INTRODUCTION TO CONVENTIONAL AND FUTURISTIC ELECTRICAL POWERSYSTEMS	9

Basics of electrical systems, laws of physics, applicability of KVL and KCL, formation of grid and concept of infinite bus, control of active and reactive power, control of voltage and frequency, generators and loads and their requirements, Infrastructure of conventional electrical networks, Main characteristics of conventional electrical networks, generation – transmission and distribution – Indian scenario, EHVAC and HVDC systems etc.

UNIT-II	COMPARISON BETWEEN SMART GRID AND CONVENTIONAL ELECTRICALNETWORKS	9

Evolution of ElectricGrid, motives behind developing the Smart Grid Network, Definitions, Characteristics and Benefits of the Smart Grid, Functions of Smart Grid Components, Key challenges for Smart Grid, Present development and International practices in Smart Grid

UNIT-III	SMART GRID SYSTEMS	9

Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Issues Associated with Sustainable Energy Technology, Electric Vehicles and Plug-in Hybrids, Impact of PHEV on the Grid, Environmental Implications – Climate Change, Implications of Climate Change. Storage Technologies, Benefits of Energy Storage Systems (ESS), prediction requirements in power systems and role of smart grids, analytics and data processing requirements, relevant case studies

UNIT-IV	SMART GRID MEASUREMENTS AND COMMUNICATION TECHNOLOGIES	9

Smart Meters – Key Components of Smart Metering, Smart Appliances, Advanced Metering Infrastructure (AMI), GIS and Google Mapping Tools, Communications Infrastructure and Protocols for Smart Metering, IoT and smart grids, Wireless Sensor Networks, Smart Grid Communication Technologies – Wireless and Wired, Cyber Attacks and Power System Security, Smart Grid Cyber Security, Protection in power systems and recent developments

UNIT-V	MACHINE LEARNING AND BIG DATA IN SMART GRIDS	9

Concepts such as MINLP Approach for Network Reconfiguration and Dispatch in Distribution Systems, Multi-Objective Optimization Methods for Solving the Economic Emission Dispatch Problem, State Estimation Paradigm Based on Artificial Dynamic Models, Cloud Computing for Smart Grid, Data Storage, Data Access and Data Analysis, The State-of- the-Art Processing Techniques of Big Data etc

	COURSE OUTCOMES
	On completion of the course, students will be able to
CO1	Compare conventional and smart power grid characteristics
CO2	Apply engineering concepts to smart electrical grid
CO3	Select and employ various sensing technologies, networking and communicationtechnologies to electrical power grid
CO4	Identify problems and offer solution using computational techniques
CO5	Implement Cloud Computing for Smart Grids

TEXTBOOKS

1. Salman K. Salman, Introduction to the Smart Grid: Concepts, Technologies and Evolution, The Institution of Engineering and Technology (IET).
2. Ahmed F Zobaa (ed.), Alfredo Vaccaro (ed.), Computational Intelligence Applications In Smart Grids - Enabling Methodologies For Proactive and Self-Organizing Power Systems, Imperial College Press
3. Robert C. Qiu and Paul Antonik, Smart Grid using Big Data Analytics - A Random Matrix TheoryApproach, Wiley
4. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Smart Grid: Technology and Applications, John Wiley & Sons.
5. James Momoh, Smart Grid: Fundamentals of Design and Analysis, John Wiley & Sons, IEEE Press

REFERENCES

1. Clark W. Gellings, The Smart Grid, Enabling Energy Efficiency and Demand Response, CRC m Press.
2. Ali Keyhani, Design of smart power grid renewable energy systems, Wiley IEEE
3. Siddhartha Kumar Khaitan, James D. McCalley, Chen-Ching Liu (ed.), Cyber Physical Systems Approach to Smart Electric Power Grid, Springer
4. Relevant recent literature, journal articles, web resources, standards and codes

COURSE CODE	191EE548
COURSE TITLE	POWER ELECTRONICS &APPLICATIONS

COURSE OBJECTIVES
- To study the constructional structures of Power semi-conductor devices.
- To calculate and compare output average expressions for rectifiers and choppers.
- To understand the concepts of inverters, dual converters and cyclo converters.
- To know the power semiconductor applications in electric vehicle and power system.
- To provide the knowledge about power electronics in industrial applications.

SEMESTER	SCHEME AND CREDITS			
	L	T	P	CREDITS
	3	0	0	3

UNIT- 1	POWER SEMI CONDUCTOR DEVICES	9

Power Diode, SCR, TRIAC: Construction, working,VI characteristics and switching characteristics. Power MOSFET andIGBT: Construction,working,transfer characteristics and output characteristics.

UNIT-2	RECTIFIER AND CHOPPER CIRCUITS	9

AC to DC Rectifiers: single phase and three phase fully controlled rectifiers, DC choppers: Types-Control strategies ofchoppers- Single quadrant, two quadrant and four quadrant choppers.

UNIT-3	INVERTER CIRCUITS ,DUAL CONVERTERS AND CYCLOCONVERTERS	9

Voltage driven and Current driven inverters-Three phase bridge inverter-Dual converters: Principle and types with circulatory and non circulatory current mode operations-Cyclo converters: Principle and types, single phase to single phase and three phase cyclo converters.

UNIT-4	APPLICATIONS IN ELECTRIC VEHICLE AND POWER SYSTEMS	9

Battery charging control and electric motor speed control in Electric Vehicles-Power conversions in solar PV system, HVDCand HVAC transmission systems-Static VAR compensation system.

UNIT-5	INDUSTRIAL APPLICATIONS	9

Static circuit breaker (DC and AC) - Induction heating-Electric welding control-AC voltage stabilizer-UPS, Closed loopspeed control of AC and DC servo motors.

COURSE OUTCOMES

After the completion of the course, Students will be able to
- Describe the construction, principle of operation and performance of thyristors and Power transistors.
- Demonstrate the working principle and control of rectifiers and choppers.
- Discuss about the working principle of inverters, dual converters and cyclo converters.
- Apply the power electronics control techniques in electric vehicle and power systems.
- Analyze about various industrial applications related to power electronics.

TEXT BOOKS

1. M.H. Rashid, Power Electronics: Circuits, Devices and Application, Fourth edition, PrenticeHall of India, 2017.
2. MukundR.Patel, Introduction to Electrical Power and Power Electronics, First edition, CRCPress, 2017.
3. Jain Alok, Power electronics and its applications, Penram International publishing,Third edition,2016.

REFERENCE BOOKS

1. P.S. Bimbra, Power Electronics, Khanna Publishers, 6th Edition, 2018.
2. Joseph Vithayathil, Power Electronics, Principles and Applications', McGraw Hill Series, 6thReprint, 2013.
3. Ned Mohan, Tore M. Undeland and William P.Robbins, Power Electronics: Converters,Applications and Design, John Wiley and Sons, Third edition, 2002.
4. V.R.Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', OxfordUniversity Press, 1st Edition, 2005.
5. John.G.Hayes, Electric Power train: Energy systems, Power Electronics and Drives for Hybrid electric and fuel cell vehicles, 2018.

YEAR	III	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		191ME544/ LEAN SIX SIGMA		3	0	0	3

COURSE OBJECTIVES
• To gain insights about the importance of lean manufacturing and six sigma practices

SYLLABUS		
UNIT-I	LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTAL	9

Historical Overview – Definition of quality – What is six sigma -TQM and Six sigma – lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes –six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions.

UNIT-II	THE SCOPE OF TOOLS AND TECHNIQUES	9

Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter –Tools for measurement, Flowprocess charts, Process Capability Measurement, Tools for analysis –interrelationship diagram, overall equipment effectiveness, innovative problem solving – Tools for improvement — Tools for control .

UNIT-III	SIX SIGMA METHODOLOGIES	9

Design For Six Sigma (DFSS),Design For Six Sigma Method - Failure Mode Effect Analysis(FMEA), FMEA process - Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder

UNIT-IV	SIX SIGMA IMPLEMENTATION AND CHALLENGES	9

Tools for implementation – Supplier Input Process Output Customer (SIPOC) – Quality Function Deployment or House of Quality (QFD) – alternative approach –implementation – leadership training, close communication system, project selection – project management and team –champion training – customer quality index – challenges – program failure, CPQ Vs six sigma, structure the deployment of six sigma – cultural challenge – customer/internal metrics

UNIT-V	SAP	9

Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S.

COURSE OUTCOMES
1. Relate the tools and techniques of lean sigma 2. Apply tools and techniques of lean sigma to increase productivity 3. Relate the techniques and methodologies of lean sigma 4. Explain about the six sigma implementation and challenges 5. Explain about evaluation and continuous improvement methods

REFERENCES
1. Michael L.George, David Rownalds, Bill Kastle, What is Lean Six Sigma, McGraw – Hill,2003 2. Thomas Pyzdek, The Six Sigma Handbook, McGraw-Hill,2000 3. Fred Soleimannejed , Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004 4. Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma: A Practical Guide to Applying, Assessing, and Implementing the Strategy That Yields Bottom-Line Success, John Wiley & Sons, 2000 5. James P. Womack, Daniel T.Jones, Lean Thinking, Free Press Business, 2003

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191ME543/ ENERGY CONSERVATION ANDMANAGEMENT		3	0	0	3

COURSE OBJECTIVES
• To expose students to analysis the energy data of industries, carryout energy accounting and balancing, conduct energy audit and suggest methodologies for energy savings and utilize the available resources in optimal ways.

SYLLABUS		
UNIT-I	INTRODUCTION	9

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT-II	ELECTRICAL SYSTEMS	9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT-III	THERMAL SYSTEMS	9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators& Refractories

UNIT-IV	ENERGY CONSERVATION IN MAJOR UTILITIES	9

Energy conservation inPumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets.

UNIT-V	ECONOMICS	9

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept .

COURSE OUTCOMES
Analyze the energy data of industries and carry out energy accounting and balancing
Calculate the energy savings in electrical systems.
Calculate the energy savings in thermal systems
Carry out energy conservation procedures in major utilities
Suggest methodologies for energy savings

REFERENCES
1. Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.   2. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Pub., Washington, 1988.   3. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.   4. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982   5. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.   6. Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths, London 1987

YEAR		SEMESTER		L	T	P	C
COURSE CODE / COURSE TITLE		**191ME542/ DESIGN THINKING**		3	0	0	3

COURSE OBJECTIVES
• To provide step by step in-depth understanding on various aspects of innovation, creativity and evolving business models to students.

SYLLABUS	
UNIT-I **INTRODUCTION TO DESIGN THINKING**	**9**
Introduction - Create Thinking - Generating Design Ideas - Lateral Thinking – Analogies – Brainstorming - Mind mapping -National Group Technique – Synectics - Development of work - Analytical Thinking.	
UNIT-II **EMPATHIZE PHASE**	**9**
Identifying a design challenge- ways to conduct design research by observing and engaging-Deliverables for the EmpathyStage-A framework for empathy in design.	
UNIT-III **ANALYZE PHASE**	**9**
Use of empathy map, Organization of design concept and design methods, Engineering Design - Descriptive and prescriptive model, Design decisions and development of design.	
UNIT-IV **IDEATION PHASE**	**9**
Steps in Ideate Phase, creative process and creative principles, Creativity techniques, Evaluation of ideas, How to prototype,Prototype Phase, Lean Startup Method for Prototype Development, Visualization and presentation techniques.	
UNIT-V **TEST PHASE**	**9**
Steps in test Phase, Tips for interviews, Tips for surveys, Kano Model, Desirability Testing, ways to conduct a workshop,Requirements for the space, Material requirements, Agility for Design Thinking.	

COURSE OUTCOMES
1.Apply the basic techniques for design thinking 2.Apply the techniques for empathizing a design thinking. 3.Apply the techniques of design thinking for analysis 4.Apply the techniques of design thinking for Ideation 5.Apply the techniques of design thinking for testing

REFERENCES
1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition)Second Edition, 2013. 2. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011. 3. Otto. K and Wood, K, Product Design, Pearson Education, 2001. 4. Pahl. G and Beitz. G, Engineering Design, Springer, 1996.

YEAR		SEMESTER		L	T	P	C
COURSE CODE / COURSE TITLE		191ME546/ RENEWABLE ENERGY SOURCES		3	0	0	3

COURSE OBJECTIVES
• To introduce the new methodologies technologies for effective utilization of renewable energy sources.

SYLLABUS		
UNIT-I	INTRODUCTION	9
World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil Nadu, India and around the World – Potentials – Achievements Applications – Economics of renewable energy systems.		
UNIT-II	SOLAR ENERGY	9
Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.		
UNIT-III	WIND ENERGY	9
Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of WindTurbine Generator – Safety and Environmental Aspects		
UNIT-IV	BIO ENERGY	9
Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Application, Biomass Feedstocks, Biomass to Biofuel Supply Chain		
UNIT-V	OTHER RENEWABLE ENERGY SOURCES	9
Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage -Fuel Cell Systems – Hybrid Systems, Greenhouse Gas and its effect on climate change		

	COURSE OUTCOMES On completion of the course, students will be able to
CO1	Identify the ways for effective utilization of renewable energy sources.
CO2	Relate and analyze the various solar energy based renewable energy generation.
CO3	Relate and analyze the various wind energy based renewable energy generation
CO4	Relate and analyze the various Bio-energy based renewable energy generation
CO5	Identify the merits of new methodologies and technologies for renewable energy generation

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1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011. 2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006. 3. Sukhatme. S.P., "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997. 4. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996. 5. Tiwari. G.N., Solar Energy – "Fundamentals Design, Modelling & Applications", Narosa Publishing House, New Delhi,2002. 6. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990. 7. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985 8. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2010 9. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited,New Delhi, 2009.