Vel Tech Multi Tech

Dr.Rangarajan Dr.Sagunthala Engineering College

An Autonomous Institution

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E–COMPUTER SCIENCE AND ENGINEERING

CURRICULUM SYLLABUS – Regulation 2019

SEMESTER I

Course Code	Name of the Course	Category	L	T	P	Credits
191MA101	Engineering Mathematics – I	BS	2	2	0	3
191PH101	Engineering Physics	BS	3	0	0	3
191CH101	Engineering Chemistry	BS	3	0	0	3
191HS101	English for Engineering Students	HSS	3	0	0	3
191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
191PH10A	Physics Laboratory	BS	0	0	2	1
191CH10A	Chemistry Laboratory	BS	0	0	2	1
191ME11A	Engineering Practices Laboratory	ES	0	0	4	2
		Total	**17**	**2**	**8**	**22**

SEMESTER II

Course Code	Name of the Course	Category	L	T	P	Credits
191MA201	Engineering Mathematics II	BS	2	2	0	3
191EC211	Electron Devices and Circuits	ES	3	0	0	3
191EC212	Digital System Design	ES	3	0	0	3
191ME211	Engineering Graphics	ES	2	2	0	3
191CS221	Problem Solving and Python Programming	PC	3	0	0	3
191HS201	Environmental Science and Engineering	HSS	3	0	0	3
191EC21A	Circuits and Devices Laboratory	ES	0	0	2	1
191EC21B	Digital System Design Laboratory	ES	0	0	2	1
191CS22A	Problem Solving and Python Programming Laboratory	PC	0	0	2	1
		Total	**16**	**4**	**6**	**21**

SEMESTER III

Course Code	Name of the Course	Category	L	T	P	Credits
191MA303	Probability and statistics	BS	2	2	0	3
191CS321	Data Structures	PC	3	0	0	3
191CS322	Computer Architecture	PC	3	0	0	3
191CS323	Object oriented Programming	PC	3	0	0	3
191CS324	Software Engineering	PC	3	0	0	3
191EC311	Communication Engineering	ES	3	0	0	3
191CS32A	Data Structures Laboratory	PC	0	0	2	1
191CS32B	Object oriented Programming Laboratory	PC	0	0	2	1
191HS30A	Advanced Reading and Writing skill Laboratory	HSS	0	0	2	1
		Total	**17**	**2**	**6**	**21**

SEMESTER IV

Course Code	Name of the Course	Category	L	T	P	Credits
191MA403	Discrete Mathematics	BS	2	2	0	3
191CS424	Computer Networks	PC	3	0	0	3
191CS422	Database Management Systems	PC	3	0	0	3
191CS421	Design and Analysis of Algorithms	PC	3	0	0	3
191CS423	Operating Systems	PC	3	0	0	3
191CS425	Theory of Computation	PC	3	0	0	3
191CS42A	**Database Management Systems Laboratory**	PC	0	0	2	1
191CS42C	**Networks Laboratory**	PC	0	0	2	1
191CS42B	**Operating Systems Laboratory**	PC	0	0	2	1
191MC46A	**Internship / Training - I**	MC	0	0	0	**
		Total	**17**	**2**	**6**	**21**

SEMESTER V

Course Code	Name of the Course	Category	L	T	P	Credits
191MA501	Numerical Methods and Number Theory	BS	2	2	0	3
191CS521	Mobile Computing	PC	3	0	0	3
191EC511	Microprocessors and Microcontrollers	ES	3	0	0	3
	Professional Elective – I	PE	3	0	0	3
	Professional Elective – II	PE	3	0	0	3
	Open Elective – I	OE	3	0	0	3
191CS52A	Mobile Application Development Laboratory	PC	0	0	2	1
191EC51A	Microprocessors and Microcontrollers Laboratory	ES	0	0	2	1
191HS50A	Professional Communication	HSS	0	0	2	1
191MC56A	Technical Seminar	MC	0	0	0	**

Total	**17**	**2**	**6**	**21**

SEMESTER VI

Course Code	Name of the Course	Category	L	T	P	Credits
191IT621	Artificial Intelligence	PC	3	0	0	3
191CS621	Compiler Design	PC	3	0	0	3
191CS622	Internet Programming	PC	3	0	0	3
	Professional Elective - III	PE	3	0	0	3
	Open Elective - II	OE	3	0	0	3
191CS62A	**Compiler Design Laboratory**	PC	0	0	2	1
191CS62B	**Internet Programming Laboratory**	PC	0	0	2	1
191CS67A	**Miniproject**	PROJ	0	0	4	2
191MC66A	**Internship / Training - II**	MC	0	0	0	**
		Total	**15**	**0**	**8**	**19**

SEMESTER VII

Course Code	Name of the Course	Category	L	T	P	Credits
191CS722	Cryptography and Network Security	PC	3	0	0	3
191CS721	Cloud Computing	PC	3	0	0	3
	Professional Elective – IV	PE	3	0	0	3
	Professional Elective – V	PE	3	0	0	3
	Open Elective – III	OE	3	0	0	3
191CS72B	Security Lab	PC	0	0	2	1
191CS72A	Cloud Computing Laboratory	PC	0	0	2	1
191CS77A	Project Work - Phase I	PROJ	0	0	2	2
		Total	**15**	**0**	**6**	**19**

SEMESTER VIII

Course Code	Name of the Course	Category	L	T	P	Credits
	Professional Elective - VI	PE	3	0	0	3
	Open Elective - IV	OE	3	0	0	3
191CS87A	Project Work - Phase II	PROJ	0	0	20	10
		Total	**6**	**0**	**20**	**10**

LIST OF PROFESSIONAL ELECTIVES

Semester	Professional Elective	ourse Cod	Name of the Course	Category	L	T	P	C
V	I	191CS531	Big Data Analytics	PE	3	0	0	3
V		191CS533	Digital Signal Processing	PE	3	0	0	3
V		191CS534	Graph Theory and Applications	PE	3	0	0	3
V		191CS535	Intellectual Property Rights	PE	3	0	0	3
V		191CS536	Software Testing	PE	3	0	0	3
V		191CS532	Computer Graphics	PE	3	0	0	3
V	II	191CS537	Agile Methodologies	PE	3	0	0	3
V		191CS538	Distributed Systems	PE	3	0	0	3
V		191CS539	Internet-of-Things	PE	3	0	0	3
V		191CS5310	Machine Learning Techniques	PE	3	0	0	3
V		191CS5311	Software Project Management	PE	3	0	0	3
V		191CS5312	Speech Processing	PE	3	0	0	3
VI	III	191CS631	Adhoc and Sensor Networks	PE	3	0	0	3
VI		191CS632	C# and .Net Programming	PE	3	0	0	3
VI		191CS633	Data Warehousing and Data Mining	PE	3	0	0	3
VI		191CS634	Fundamentals of Nano Science	PE	3	0	0	3
VI		191CS635	Human Computer Interaction	PE	3	0	0	3
VI		191CS636	Information Retrieval Techniques	PE	3	0	0	3
VII	IV	191CS731	Advanced Computer Architecture	PE	3	0	0	3
VII		191CS735	Principles of Management	PE	3	0	0	3
VII		191CS732	Digital Image Processing	PE	3	0	0	3
VII		191CS733	Embedded Systems	PE	3	0	0	3
VII		191CS734	Natural Language Processing	PE	3	0	0	3
VII		191CS736	Service Oriented Architecture	PE	3	0	0	3
VII		191CS737	Social Network Analysis	PE	3	0	0	3
VII	V	191CS738	Cyber Forensics	PE	3	0	0	3
VII		191CS739	Grid and Cloud Computing	PE	3	0	0	3
VII		191CS740	Information Security	PE	3	0	0	3
VII		191CS741	Neural Networks and Deep Learning	PE	3	0	0	3
VII		191CS742	Soft Computing	PE	3	0	0	3
VII		191CS743	Software Defined Networks	PE	3	0	0	3
VII		191HS701	Total Quality Management	PE	3	0	0	3
VIII	VI	191HS801	Professional Ethics in Engineering	PE	3	0	0	3
VIII		191CS832	Green Computing	PE	3	0	0	3
VIII		191CS833	Information Theory and Coding	PE	3	0	0	3
VIII		191CS834	Multi-Core Architectures and Programming	PE	3	0	0	3
VIII		191CS835	Parallel Algorithms	PE	3	0	0	3
VIII		191CS836	Real Time Systems	PE	3	0	0	3
VIII		191CS831	GPU Architecture and Programming	PE	3	0	0	3

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 higher order differential equations.

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. "EngineeringMathematics", Vol. I (4th revised edition), S. Chand & Co, New Delhi, 2000.

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
CO 1	3	3	2	2	2	-	-	-	-	-	-	1	-	-	1
CO 2	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO 3	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO 4	3	3	2	2	1	-	-	-		-	-	1	-	-	1
CO 5	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1

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 broader sense 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, mono chromaticity, 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 fiber 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 wave function, 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 spacing, 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, Dhanpat Rai 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	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 5	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 real time 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 energy storage.

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.

REFERENCES

1. Gesser H.D., "Applied Chemistry - A Textbook for Engineers and Technologies", Springer, New York, 2008.
2. Gowarikar V. R., Viswanathan N.V and JayadevSreedhar, "Polymer Science", New Age International (P) Ltd., New Delhi, 2011
3. Vijayamohanan K. Pillai and MeeraParthasarathy, "Functional Materials - A Chemist's Perspective" Universities Press, India, 2012.
4. ShashiChawla, "A Text book of Engineering Chemistry", DhanpatRai& Co, New Delhi, 2005.

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	1	1
CO2	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	1	1	1
CO3	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	1	1	1
CO4	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	1	1	1
CO5	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	1	1	1
CO	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	1	1	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 to engage 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	2	1	-	-	-	-	-	2	2	-	2	1	-	-
CO2	3	2	1	-	-	-	-	-	2	2	-	2	1	-	-
CO3	3	2	1	-	-	-	-	-	2	2	-	2	1	-	-
CO4	3	2	1	-	-	-	-	-	2	2	-	2	1	-	-
CO5	3	2	1	-	-	-	-	-	2	2	-	2	1	-	-
CO	3	2	1	-	-	-	-	-	2	2	-	2	**1**	-	-

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 REFRIGIRATION	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	Learn the usage of construction material and proper selection of construction materials
CO2	Identify about water resources, sewage treatment and transportation systems
CO3	Design the components use in power plants
CO4	Describe the internal combustion engines
CO5	Analyse 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	2	2	1	-	-	-	2	2	1	1
CO2	3	3	1	1	-	2	2	1	-	-	-	2	2	1	1
CO3	3	3	1	1	-	2	2	1	-	-	-	2	2	1	1
CO4	3	3	1	1	-	2	2	1	-	-	-	2	2	1	1
CO5	3	3	1	1	-	2	2	1	-	-	-	2	2	1	1
CO	3	3	1	1	-	2	2	1	-	-	-	2	2	1	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	-	-	-	-	-	-	-	-	-	2	1	1
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	1	1
CO3	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO4	2	1	1	1	1	-	-	-	-	-	-	-	2	1	1
CO5	2	1	1	1	-	-	-	-	-	-	-	-	2	1	1
CO	3	2	2	1	1	-	-	-	-	-	-	-	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 may use 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.

DEMONSTRATION	
1	Determination of wavelength of mercury spectrum – spectrometer grating.
2	Demonstration of Crystal Growth Technique.
3	Determination of fiber thickness – Air Wedge method.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Apply the principles of properties of matter in determining the various elastic properties
CO2	Attains the practical knowledge, to apply principles of optics for various engineering applications
CO3	Demonstrate the technical knowledge on Quantum Mechanical concepts

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

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
CO 1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 3	3	3	2	2	-	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.

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
CO 1	3	3	2	2	-	2	2	2	2	-	-	2	2	1	1
CO 2	3	3	2	2	-	2	2	2	2	-	-	2	2	1	1
CO 3	3	3	2	2	-	2	2	2	2	-	-	2	2	1	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 equipment's - Resistor, color 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	Molding 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	Multi meters	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	Use mechanical and civil engineering equipments to join the structures and perform basic machining operations and fabricate models in sheet meta
CO2	Use electrical and electronics engineering equipments to test the respective electrical .

CO-PO&PSOMapping

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

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 using multiple integral
- ✓ To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and 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 evaluates their 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	1	1	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	1	1	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	1	1	-	-
CO4	3	3	2	2	2	-	-	-		-	-	1	1	-	-
CO5	3	3	2	2	2	-	-	-	-	-	-	1	1	-	-
CO	3	3	2	2	2	-	-	-	-	-	-	1	1	-	-

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191EC211 / ELECTRON DEVICES AND CIRCUITS			3	0	0	3

COURSE OBJECTIVES

- ✓To understand the concept of semiconductor diode.
- ✓To learn the operation and characteristics of BJT and FET transistors.
- ✓To study various types of display and power devices.
- ✓To learn positive and negative feedback circuits.

SYLLABUS

UNIT-I	SEMICONDUCTOR DIODES	9

Ideal diode, Current-voltage characteristics, Terminal characteristics of junction diode, Zener diode and applications, Diode logic gates, Clipping and Clamping circuits, Voltage doubler, Schottky-Barrier diode, Varactor, Photo diode, Tunnel diode.

UNIT-II	TRANSISTOR AMPLIFIER	9

BJT- Structure, Operation, Three modes of configuration, Currents in Transistor, Relation between α, β & γ, load line, Transistor as an amplifier (CE), h parameter, Av and Ap.

UNIT-III	FIELD EFFECT TRANSISTOR	9

JFET, Structure, Operation of N Channel and P Channel, Drain and Transfer characteristics, Applications of JFET, MOSFET types, Characteristics of Enhancement and depletion mode, Comparison of JFET and MOSFET.

UNIT-IV	POWER DEVICES AND DISPLAY DEVICES	9

SCR, DIAC, TRIAC, Power BJT, Power MOSFET, IGBT Heat sinks and junction temperature, LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

UNIT-V	FEEDBACK AMPLIFIERS AND OSCILLATORS	9

Advantages of negative feedback, Voltage/current, series/shunt feedback. Positive feedback, Barkhausen criterion for oscillation, Phase shift, Wein Bridge, Hartley, Colpitts and crystal oscillators.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Analyze PN junctions in semiconductor devices under various conditions
CO2	Understand the Characteristics of current flow in BJT with CB,CE and CC configurations
CO3	Realize the characteristics of MOS and FET amplifier
CO4	Discuss the characteristics of power and display devices.

CO5	Employ the acquired knowledge in design and analysis of feedback amplifiers and oscillators.

TEXT BOOKS

1. Sedra and Smith, "Micro Electronic Circuits", Sixth Edition, Oxford University Press, 2011.
2.Donald A Neaman, "Semiconductor Physics and Devices", Third Edition, Tata McGrawHill Inc. 2007.

REFERENCES

1. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008.
2. Malvino, "Electronic Devices and Circuits", PHI, 2007.
3. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008.
4. Salivahanan. S, Suresh Kumar. N, Vallavaraj. A, "Electronic Devices and circuits", Third Edition, Tata McGraw- Hill, 2008.

CO-PO & PSO Mapping

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

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191EC212 / DIGITAL SYSTEM DESIGN			3	0	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 sequential circuits.
- ✓ 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 .
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	Review the various memory and programmable logic 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.

CO-PO & PSO Mapping

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

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 in real 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.

CO-PO&PSOMapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	-	2	1	-	-	-	1	1	1	1	1	1
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CO 3	3	3	3	-	2	1	-	-	-	1	1	1	1	1	1
CO 4	3	3	3	-	2	1	-	-	-	1	1	1	1	1	1
CO 5	3	3	3	-	2	1	-	-	-	1	1	1	1	1	1
CO	3	3	3	-	2	1	-	-	-	1	1	1	1	1	1

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191CS221 / 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, packages; 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	Distinguish list tuples and dictionaries in python programming.
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 forPython 3, Shroff O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/).
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 expandedEdition, 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-SolvingFocus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to ComputerScience 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	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	-	2	3	3	-	-	-	2	3	3	1
CO 2	3	3	2	2	-	2	3	-	-	-	-	2	3	2	1
CO 3	3	3	2	2	-	2	3	-	-	-	-	2	3	2	1
CO 4	3	3	2	2	-	2	3	-	-	-	-	2	3	2	1
CO 5	3	3	2	2	-	2	3	3	-	-	-	2	3	2	1
CO	3	3	2	2	-	2	3	3	-	-	-	2	3	2	1

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	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	
CO1	Interpret the concept of ecosystem, biodiversity and its conservation.
CO2	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.
CO5	Recall the environmental ethics and legal provisions.

TEXT BOOKS

1. ErachBharucha, "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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	-	2	3	3	-	-	-	2	1	-	-
CO 2	3	3	2	2	-	2	3	-	-	-	-	2	1	-	-
CO 3	3	3	2	2	-	2	3	-	-	-	-	2	1	-	-
CO 4	3	3	2	2	-	2	3	-	-	-	-	2	1	-	-
CO 5	3	3	2	2	-	2	3	3	-	-	-	2	1	-	-
CO	3	3	2	2	-	2	3	3	-	-	-	2	1	-	-

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191EC21A / CIRCUITS AND DEVICE LABORATORY			0	0	2	1

COURSE OBJECTIVES
✓ To learn the characteristics of basic electronic devices such as Diode, BJT, FET,SCR. ✓ To understand the application of PN junction diode. ✓ To differentiate the operation of oscillators.

LIST OF EXPERIMENTS	
1	Characteristics of PN Junction Diode.
2	Zener diode Characteristics & Regulator using Zenerdiode.
3	Common Emitter input-output Characteristics.
4	Common Emitter input-output Characteristics.
5	Common Base input-output Characteristics.
6	FET Characteristics.
7	SCR Characteristics.
8	Positive and negative Clipper.
9	Positive and negative Clamper.
10	FWR and ripple factor calculation.
11	RC Phase shift oscillator and Wien Bridge Oscillator.
12	Hartley Oscillator and Colpitts Oscillator.

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Construct and Analyze the characteristics of PN junction diode , Zener diode and Silicon Controlled Rectifier, FET.
CO2	Design and Implement the various Amplifiers like Common Emitter, Common Base and observe their frequency responses.
CO3	Verify different network theorems

CO-PO & PSO Mapping

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

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191EC21B / DIGITAL SYSTEM DESIGN 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	Build combinational logic circuits for a given application using logic gates, multiplexers, decoders and encoders.
CO2	Build sequential logic circuits for a given application using the given type of flip flops.
CO3	Simulate and test simple combinational logic circuits using Hardware Description Language (HDL).

CO-PO & PSO Mapping

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

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE / COURSE TITLE	191CS22A / PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY			0	0	2	1

COURSE OBJECTIVES

- Write, test, and debug simple Python programs.
- 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	Python versions, advancements and applications of python - Case Study.
15	Mini project

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Solve problems using conditionals and loops in Python.
CO2	Develop Python programs by defining functions.
CO3	Use lists, Tuples and dictionaries for solving complex program in python.
CO4	Create Python programs using files.

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
CO 1	3	2	1	1	-	-	-	-	-	-	-	1	3	3	1
CO 2	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1
CO 3	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1
CO 4	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1
CO	3	2	1	1	-	-	-	-	-	-	-	1	3	2	1

SEMESTER – III

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191MA303 / PROBABILITY AND STATISTICS			2	2	0	3

COURSE OBJECTIVES

1. Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
2. 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	Analyze 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 studythe 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 ", TataMcGraw Hill Edition, 2004.
4. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers andScientists", 8th Edition, Pearson Education, Asia, 2007.

Course Outcome	Mapping CO's with PO's														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO	3	3	**2**	**2**	1	-	-	-	-	-	-	1	3	1	1

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191CS321 / DATA STRUCTURE			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 Stacksand Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT-IV	NON-LINEAR DATA STRUCTURES	9

Trees, Binary Trees, Binary tree representation and traversals, AVL tree ,B tree , B+ tree, Binary Search Trees, 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, Hash tables,Overflow handling.

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Describe the basics of C programming language
CO2	Practice the concepts of functions, pointers, structures and unions for the given application
CO3	Interpret and implement linear data structure operations in C
CO4	Analyze and evaluate non linear 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"SpringerEdition 2015

REFERENCES

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996

2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.

3. Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , — Data Structures and Program Design in C, Second Edition, Pearson Education, 2007

4. Jean-Paul Tremblay and Paul G. Sorenson, —An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.Rance D. Necaise, "Data Structures and algorithms Using Python", John Wiley &Sons, 2011

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	2	-	-	-	-	-	2	3	3	1
CO2	3	3	3	3	3	2	-	-	-	-	-	2	3	3	1
CO3	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO4	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO5	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**2**

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

COURSE OBJECTIVES

- ✓ To conceptualize the basic structure and operations of a computer.
- ✓ To study the basic working principles of arithmetic and logic unit and implement fixed-point and floating point arithmetic algorithms.
- ✓ To learn the basics of pipelined execution.
- ✓ To understand parallelism and multi-core processors.
- ✓ To describe the concepts of memory hierarchies, cache memories and virtual memories

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 – Sub word Parallelism.

UNIT-III	**PROCESSOR AND CONTROL UNIT**	**9**

A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelineddata path and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT-IV	**PARALLELISIM**	**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, Case Study- PARAM Siddhi - AI**.**

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define the basics concepts of fundamental component, architecture, register organization and performance metrics of a computer.
CO2	Illustrate the efficient algorithm for binary arithmetic operations.
CO3	Construct an efficient data path for an instruction format for a given architecture.
CO4	Categorize various parallel processors.
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 Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, 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 Computer Architecture

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

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE /COURSETITLE	191CS323/OBJECTORIENTEDPROGRAMMING			3	0	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 BASICS	9

Object Oriented Programming-Abstraction–objects and classes -Encapsulation-Inheritance-Polymorphism-OOPinJava–Characteristics of Java–The Java Environment-Java Source File-Structure– Compilation. FundamentalProgrammingStructuresinJava–DefiningclassesinJava–constructors, methods -access specifiers -static members-Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages–Java Doc comments.

UNIT-II	INHERITANCEANDINTERFACES	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, implementinginterface,differencesbetweenclassesandinterfacesandextendinginterfaces–Objectcloning-innerclasses,ArrayLists–Strings.

UNIT-III	EXCEPTIONHANDLINGANDI/O	9

Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, StackTraceElements.Input/OutputBasics–Streams–BytestreamsandCharacterstreams –Reading and Writing Console–Reading and Writing Files.

UNIT-IV	MULTITHREADINGANDGENERICPROGRAMMING	9

Differencesbetweenmulti-threadingandmultitasking,threadlifecycle,creatingthreads,synchronizingthreads,Inter-thread communication, Thread priorities, daemon threads, thread groups, .Generic Programming – Generic classes – generic methods–Bounded Types–Restrictions and Limitations.

UNIT-V	EVENTDRIVEN 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–mouseevents–AWTeventhierarchy–IntroductiontoSwing–layoutmanagement–SwingComponents–TextFields,TextAreas–Buttons-CheckBoxes–RadioButtons–Lists- choices- Scrollbars–Windows–Menus–Dialog Boxes.

COURSE OUTCOMES On completion of the course ,students will be able to	
CO1	Acquire knowledge in OOPS concept and define the structure of Java programs.
CO2	Identify the concept of inheritance, interfaces and illustrate the Java Programs.
CO3	Develop Java 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

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
CO 1	3	2	2	1	-	-	-	1	-	-	-	1	2	2	3
CO 2	3	2	2	1	-	-	-	1	-	-	-	1	2	2	2
CO 3	3	2	2	1	-	-	-	1	-	-	-	1	2	2	3
CO 4	3	2	2	1	-	-	1	1	-	-	-	1	3	2	3
CO 5	3	3	2	1	1	-	1	1	-	-	-	1	3	2	3
CO	**3**	**2**	**2**	**1**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**1**	**2**	**2**	**3**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191CS324 / SOFTWARE ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ Learn the phases in a software project
- ✓ Understand fundamental concepts of requirements engineering and Analysis Modeling.
- ✓ Study the various software design methodologies
- ✓ Explore various testing and maintenance measures

SYLLABUS

UNIT-I	SOFTWARE PROCESS AND AGILE DEVELOPMENT	9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility – Agile process – Extreme programming-XP Process

UNIT-II	REQUIREMENTS ANALYSIS AND SPECIFICATION	9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary

UNIT-III	SOFTWARE DESIGN	9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- Design Patterns-Types-User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components-.

UNIT-IV	TESTING AND MAINTENANCE	9

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model- Reengineering process model-Reverse and Forward Engineering – Testing the documentation

UNIT-V	PROJECT MANAGEMENT	9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process-Critical Path (CRM) Method- RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember the key activities in managing a software project
CO2	Identify different process models and the approach adopted in gathering requirements
CO3	Apply systematic procedure for software design and deployment.
CO4	Analyze , Compare and contrast the various testing and maintenance.
CO5	Evaluate the Management project schedule, estimate project cost and effort required

TEXT BOOKS

1. Roger S. Pressman, ―Software Engineering – A Practitioner's Approach‖, Seventh Edition, McGraw-HillInternational Edition, 2010.
2. Ian Sommerville, ―Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.

REFERENCES

1. Rajib Mall, ―Fundamentals of Software Engineering‖, Third Edition, PHI Learning Private Limited, 2009.
2. PankajJalote, ―Software Engineering, A Precise Approach‖, Wiley India, 2010.
3. Kelkar S.A., ―Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, ―Software Engineering‖, Tata McGraw-Hill Publishing Company Limited,2007. 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
CO 1	3	2	1	1	-	-	-	-	-	-	-	-	2	2	1
CO 2	3	2	1	1	-	-	-	-	-	-	1	-	1	2	2
CO 3	3	2	2	1	1	-	-	-	1	2	1	1	2	1	2
CO 4	3	2	1	1	1	-	1	1	2	2	2	2	2	1	2
CO 5	3	2	2	1	1	2	1	1	2	1	2	2	2	1	2
CO	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191EC311 / COMMUNICATION ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- ✓ To study the various analog and digital modulation techniques
- ✓ To study the principles behind information theory and coding
- ✓ To study the various digital communication techniques

SYLLABUS

UNIT-I	ANALOG MODULATION	**9**

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Super heterodyne receivers

UNIT-II	PULSE MODULATION	**9**

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

UNIT-III	DIGITAL MODULATION AND TRANSMISSION	**9**

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

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, Sequential and Viterbi decoding

UNIT-V	SPREAD SPECTRUM AND MULTIPLE ACCESS	**9**

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA

Course Outcomes At the end of the course, the student should be able to:	
CO1	Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2	Apply analog and digital communication techniques.
CO3	Use data and pulse communication techniques.
CO4	Analyze Source and Error control coding.
CO5	Use Various Spectrum and Multiple access methods

TEXT BOOKS

1. 1. H Taub, D L Schilling, G Saha, ―Principles of Communication Systems‖ 3/e, TMH 2007
2. 2. S. Haykin ―Digital Communications‖ John Wiley 2005

REFERENCES

1. B.P.Lathi, ―Modern Digital and Analog Communication Systems‖, 3rd edition, Oxford University Press, 2007
2. H P Hsu, Schaum Outline Series – ―Analog and Digital Communications‖ TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications‖ 2/e Pearson Education 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	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	1	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1	1	1	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1	2	1	1
CO5	3	3	2	2	-	-	-	-	-	-	-	1	2	1	1
CO	3	3	2	2	-	-	-	-	-	-	-	1	2	1	1

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

COURSE OBJECTIVES

- ✓ Learn linear and non-linear data structures.
- ✓ Understand the different operations of search trees.
- ✓ Implement graph traversal algorithms.
- ✓ Perform sorting and searching algorithms.

LIST OF EXPERIMENTS	
1	Array implementation of Stack and Queue ADTs.
2	Array implementation of List ADT.
3	Linked list implementation of List, Stack and Queue ADTs.
4	Applications of List, Stack and Queue ADTs.
5	Implementation of Binary Trees and operations of Binary Trees.
6	Implementation of Binary Search Trees.
7	Implementation of Expression Tree
8	Implementation of Minimum Spanning tree – Prim's Algorithm
9	Graph representation and Traversal algorithms.
10	Applications of Graphs.
11	Implementation of searching and sorting algorithms.
12	Hashing – any two collision techniques.
13	Implementation of AVL Trees.
14	Implementation of Heaps using Priority Queues.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Describe the basics of C programming language
CO2	Practice the concepts of functions, pointers, structures and unions for the given application.
CO3	Interpret and implement linear data structure operations in C.
CO4	Analyze and evaluate non linear data structure for the given application.
CO5	Apply the hashing concepts an choose the appropriate sorting algorithm for an application.

CO-PO & PSO Mapping

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

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

COURSE OBJECTIVES

- ✓ Develop applications using Object Oriented Programming Concepts
- ✓ Develop and implement Java programs principles of packages, inheritance and interfaces
- ✓ Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- ✓ Develop and implement Java programs with array list, exception handling and multithreading.
- ✓ Design applications using file processing, generic programming and event handling.

LIST OF EXPERIMENTS	
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 Array List. 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 file in bytes.
9	Write a java program that implements a multi-threaded application that has three threads. First thread 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 the value 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 following options. a. Decimal manipulations b. Scientific manipulations
12	Applet program implementing Graphics Applications
13	Develop a mini project for any application using Java concepts.

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Describe the procedural and object oriented paradigm with concepts of streams, 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	1	1	1	1	2	3	3	3	2	3
CO2	3	3	3	2	3	1	1	1	1	2	3	3	3	2	3
CO3	3	3	3	2	3	1	1	1	1	2	3	3	3	2	2
CO4	3	3	3	2	3	1	1	1	1	2	3	3	3	2	2
CO5	3	3	3	2	3	1	1	1	1	2	3	3	3	2	3
CO	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**3**	**2**	**2**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191HS30A / ADVANCED READING AND WRITING SKILL LABORATORY			0	0	2	1

COURSE OBJECTIVES
✓ Develop their communicative competence in English with specific reference to ✓ speaking and listening ✓ Enhance their ability to communicate effectively in interviews. ✓ Strengthen their prospects of success in competitive examinations.

SYLLABUS		
UNIT-I		**9**
Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title **Writing**-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph		
UNIT-II		**9**
Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in **writing**– Write a paragraph with reasons and examples- Write an opinion paragraph		
UNIT-III		**9**
Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques-**Writing**– Elements of good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.		
UNIT-IV		**9**
Reading– Genre and Organization of Ideas- **Writing**– Email writing- visumes – Job application- project writing-writing convincing proposals.		
UNIT-V		**12**
Reading– Critical reading and thinking- understanding how the text positions the reader- identify **Writing**– Statement of Purpose- letter of recommendation- Vision statement		

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Demonstrate understanding of elements of writing such as brainstorming for generating topic sentence, central ideas, supporting ideas, organization patterns, editing and drafting different types of paragraphs and essays.
CO2	Understand the strategies of skimming and scanning to read a text analytically and critically respond to it.
CO3	Apply critical thinking skills and infer a text logically in relation to various professional concerns.

TEXT BOOKS

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011.
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011.

REFERENCES

1. Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006.
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012.
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004.
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000.
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004.

CO-PO & PSO Mapping

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

SEMESTER IV

Course Code	Name of the Course	Category	L	T	P	Credits
191MA403	Discrete Mathematics	BS	2	2	0	3
191CS424	Computer Networks	PC	3	0	0	3
191CS422	Database Management Systems	PC	3	0	0	3
191CS421	Design and Analysis of Algorithms	PC	3	0	0	3
191CS423	Operating Systems	PC	3	0	0	3
191CS425	Theory of Computation	PC	3	0	0	3
191CS42A	**Database Management Systems Laboratory**	PC	0	0	2	1
191CS42C	**Networks Laboratory**	PC	0	0	2	1
191CS42B	**Operating Systems Laboratory**	PC	0	0	2	1
191MC46A	**Internship / Training - I**	MC	0	0	0	**
		Total	**17**	**2**	**6**	**21**

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

COURSE OBJECTIVES

- ✓ Extend student's logical and mathematical maturity and ability to deal with abstraction.
- ✓ Introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- ✓ Apply the basic concepts of combinatorics and graph theory.
- ✓ Familiarize the applications of algebraic structures.
- ✓ Analyse the concepts and significance of lattices and Boolean algebra.

SYLLABUS

UNIT-I	LOGIC AND PROOFS	12

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

UNIT-II	COMBINATORICS	12

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

UNIT-III	GRAPHS	12

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

UNIT-IV	ALGEBRAIC STRUCTURES	12

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

UNIT-V	LATTICES AND BOOLEAN ALGEBRA	12

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.

Course Outcome	Mapping CO's with PO's														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO	3	3	**2**	**2**	1	-	-	-	-	-	-	1	3	1	1

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

COURSE OBJECTIVES

- ✓ Learn and apply the algorithm analysis techniques.
- ✓ Understand the efficiency of alternative algorithmic solutions for the same Problem
- ✓ Apply the different algorithm design techniques.
- ✓ Analyze 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 a^n – 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.

UNIT-IV	ITERATIVE IMPROVEMENT	9

The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman 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	Remember the fundamental needs of algorithms in problem solving
CO2	Identify the Design algorithm for various computing problems
CO3	Apply the different algorithm design techniques for a given problem
CO4	Analyze the existing algorithm to improve efficiency
CO5	Evaluate the time and space complexity of various algorithms

TEXT BOOKS

1. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms/ C++", Second Edition, Universities Press, 2007.
3. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.

REFERENCES

1. Sudhakar, A. Shyammohan, "Circuits and Network", Third Edition, Tata McGraw Hill, 2006.
2. Kelkar, Pandit, "Linear Network Theory", Pratibha Publication,Third Edition,2006.
3. "Introduction to Network Synthesis", Valkenburg, PHI Pbs, Third Edition,2006.
4. "Network Analysis And Synthesis", Wadhwa, New Age Pbs, Third Edition,2006.

CO-PO & PSO Mapping

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

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

COURSE OBJECTIVES

- ✓ Learn the fundamentals of data models and to represent a database system using ER diagrams.
- ✓ Study SQL and relational database design.
- ✓ Understand the internal storage structures using different file and indexing techniques which will helpin physical DB design.
- ✓ Apply the fundamental concepts of transaction processing- concurrency control techniques andrecovery procedures.
- ✓ To evaluate an introductory knowledge about the Storage and Query processing Techniques.

SYLLABUS

UNIT-I	RELATIONAL DATABASES	10

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	8

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-Case Study on application to get discount during festival times,to list the Stock Clearance.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember the modern and futuristic database applications based on size and complexity
CO2	Identify and Map ER model to Relational model to perform database design effectively
CO3	Apply queries using normalization criteria and optimize queries
CO4	Analyze contrast various indexing strategies in different database systems
CO5	Evaluate how advanced databases differ from traditional databases

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts‖, Sixth Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, 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. RaghuRamakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill CollegePublications, 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
CO 1	3	2	1	1	1	1	-	1	1	-	-	1	1	1	1
CO 2	3	2	2	1	-	1	1	1	1	-	-	2	1	1	1
CO 3	3	2	2	1	2	1	1	1	-	-	-	1	2	2	1
CO 4	3	2	2	2	2	1	1	-	-	-	-	2	2	2	2
CO 5	3	3	2	2	1	2	2	1	2	2	2	2	2	2	2
CO	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**

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.

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Describe the Basic Concepts and functions of OS and Process.
CO2	Compare the various scheduling algorithms and Understand deadlock, prevention and avoidance algorithms.
CO3	Distinguish various memory management schemes.
CO4	Analyse the functionality of file systems
CO5	Review the administrative tasks on Linux Servers and to Compare iOS and Android Operating Systems

TEXT BOOKS

Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	-	-	-	-	-	-	1	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	1	3	2	2
CO5	3	3	3	3	3	2	2	2	1	1	2	2	3	3	3
CO	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**3**	**2**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191CS424 / 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 & LINK LAYER	9

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

UNIT-II	MEDIA ACCESS & 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	9

WWW and HTTP, FTP, Email, Telnet, SSH, DNS, SNMP.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Identify the basic layers and its functions in Computer networks and the working of various application layer protocols.
CO2	Compare the performance of a network.
CO3	Discuss the basics of how data flows from one node to another.
CO4	Analyze and design routing algorithms.
CO5	Design protocols for various functions in the network.

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

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191CS425 / THEORY OF COMPUTATION			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the language hierarchy.
- ✓ To construct automata for any given pattern and find its equivalent regular expressions.
- ✓ To design a context free grammar for any given language.
- ✓ To develope Turing machines and their capability.
- ✓ To implement undecidable problems and NP class problems.

SYLLABUS

UNIT-I	AUTOMATA FUNDAMENTALS	9

Introduction to formal proof, Additional forms of Proof, Inductive Proofs, Finite Automata, Finite Automaton with €- moves ,Deterministic Finite Automata, Non-deterministic Finite Automata, Finite Automata with Epsilon Transitions.

UNIT-II	REGULAR EXPRESSIONS AND LANGUAGES	9

Regular Languages,Regular Expressions, FA and Regular Expressions, Proving Languages not to be regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata , Equivalence of finite Automaton and regular expressions.

UNIT-III	CONTEXT FREE GRAMMAR AND LANGUAGES	9

CFG, Parse Trees, Ambiguity in Grammars and Languages, Definition of the Pushdown Automata, Languages of a Pushdown Automata, Instantaneous descriptions of PDA ,Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

UNIT-IV	PROPERTIES OF CONTEXT FREE LANGUAGES	9

Normal Forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Computable languages and functions, Programming Techniques for TM , Chomskian hierarchy of languages.

UNIT-V	UNDECIDABILITY	9

Unsolvable Problems and Computable Functions ,Non Recursive Enumerable (RE) Language, Undecidable Problem with RE, Undecidable Problems about TM, Post‘s Correspondence Problem,The Class P and NP.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Construct automata, regular expression for any pattern.
CO2	Write Context free grammar for any construct.
CO3	Design Turing machines for any language.
CO4	Propose computation solutions using Turing machines.
CO5	Derive whether a problem is decidable or not.

TEXT BOOKS

1.J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2003.

REFERENCES

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

CO-PO & PSO Mapping

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

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

COURSE OBJECTIVES

- ✓ To learn the data definitions and data manipulation commands.
- ✓ To understand the uses of nested and join queries.
- ✓ To apply functions, procedures and procedural extensions of data bases.
- ✓ To explore the Uses of the front end tool.
- ✓ To implement and design the typical database applications.

SYLLABUS

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. Views, Sequences, Synonyms.
4. Create a imaginary view table using views
5. Database Programming: Implicit and Explicit Cursors.
6. Stored Procedures and Functions.
7. Triggers
8. Write a query to demonstrate any on type of triggers
9. Exception Handling.
10. Database Design using ER modeling, normalization and Implementation for any application.
11. Database Connectivity with Front End Tools.
12. Case Study using real life database applications

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Remember typical data definitions and manipulation commands.
CO2	Identify the design applications to test Nested and Join Queries.
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.

Requirements for a batch of 30 students

Sl. No	Description of Equipment	Quantity required	Quantity available (A)	ficiency (R-A)
1	Systems with MySql	30	30	Nil
2	Visual Studio	30	30	Nil
3	Server	1	1	Nil

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	-	1	-	-	-	-	1	3	3	2	1
CO 2	3	2	2	1	-	1	-	-	-	-	1	3	2	3	1
CO 3	3	2	2	2	-	1	-	-	-	-	1	3	2	2	2
CO 4	3	2	2	2	2	2	-	-	-	-	1	3	1	2	1
CO 5	3	2	2	2	2	2	-	-	-	-	1	3	1	2	2
CO	3	2	2	2	2	1	-	-	-	-	1	3	2	2	1

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191CS42C / NETWORKS LABORATORY			0	0	2	1

COURSE OBJECTIVES
✓ To learn network commands. ✓ 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	Implementations of Stop and Wait Protocol and Sliding Window Protocol.
2	Study of Socket Programming and Client-Server model.
3	Write a code simulating ARP/RARP protocols.
4	Write a code simulating PING and TRACEROUTE commands
5	Create a socket for HTTP for web page upload and download.
6	Applications using TCP Sockets like: a. Echo client and Echo server b. Chat c. File Transfer
7	Simulation of DNS using UDP sockets.
8	Study of Network Simulator (NS) and Simulation of Congestion Control Algorithms using NS.
9	Study of TCP/UDP performance using simulation tool.
10	Study of Distance vector/Link State routing algorithm using NS.
11	Write a code simulating Go Back N ARQ.
12	Simulation of Error Correction Code (CRC).
13	MINI PROJECT

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Identify various protocols using TCP and UDP.
CO2	Compare the performance of different transport layer protocols.
CO3	Use simulation tools to measure the performance of various network protocols.
CO4	Implement various routing algorithms.
CO5	Interpret error correction codes.

REQUIREMENTS FOR A BATCH OF 30 STUDENTS				
SI NO	**DESCRIPTION OF EQUIPMENT**	**QUANTITY REQUIRED**	**QUANTITY AVAILABLE(A)**	**DEFICIENCY(R-A)**
1	STANDALONE DESKTOPS	30	30	NIL
2	C / C++ / Java / Python / Equivalent Compiler Network Simulator like NS2 / Glomosim / OPNEt / Packet Tracer / Equivalent	30	30	NIL

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	1	-	1	1	1	1	3	2	2
CO2	3	3	3	3	2	2	2	-	1	1	1	1	3	2	2
CO3	3	3	3	3	3	2	1	-	1	1	1	1	3	2	2
CO4	3	3	3	3	3	2	2	-	1	1	1	1	3	2	2
CO5	3	3	3	3	3	1	2	-	1	1	1	1	3	2	2
CO	**3**	**3**	**3**	**3**	**3**	**2**	**2**		**1**	**1**	**1**	**1**	**3**	**2**	**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	Android OS / iOS Family – Case study.
17	VMware Workstation – Case study.

REQUIREMENTS FOR A BATCH OF 30 STUDENTS

SI NO	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED	QUANTITY AVAILABLE(A)	DEFICIENCY(R-A)
1	Systems with Linux OS andGNU Computer	30	30	Nil

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Compare the performance of various CPU Scheduling Algorithms.
CO2	Implement Deadlock avoidance and Detection Algorithms.
CO3	Demonstrate 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

TEXT BOOKS

- ✓ Abraham Silber schatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2	2	2	2	2	2	2	2	3	2	2
CO2	3	3	3	2	2	2	2	2	2	2	2	2	3	2	2
CO3	3	3	3	2	2	2	2	2	2	2	2	2	3	2	2
CO4	3	3	3	2	2	2	2	2	2	2	2	2	3	2	2
CO5	3	3	3	2	2	2	2	2	2	2	2	2	3	2	2
CO	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**

SEMESTER V

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191MA501 - NUMERICAL METHODS AND NUMBER THEORY			2	2	0	3

COURSE OBJECTIVES
✓ The ability to apply the basic concepts of numerical methods and number theory in their respective engineering fields

SYLLABUS		
UNIT-I	NUMERICAL SOLUTION TO EQUATIONS	9
Solution of algebraic and transcendental equations: Newton – Raphson method – Solution of system of linear equations: Gauss elimination method – Inverse of a matrix: Gauss –Jordan method –Eigen values of a matrix by Power method.		
UNIT-II	INTERPOLATION,DIFFERENTIATION AND INTEGRATION	9
Interpolation: Newton's forward and backward interpolation formulae - Numerical differentiation: Newton's forward and backward interpolation formulae. Numerical integration: Trapezoidal rule- Simpson's rules for single integrals-Two-point Gaussian quadrature formula.		
UNIT-III	DIVISIBILTY THEORY AND CANONICAL DECOMPOSITIONS	9
Division algorithm – Base – b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.		
UNIT-IV	DIOPHANTINE EQUATIONS AND CONGRUENCES	9
Linear Diophantine equations – Congruence ‘s – Linear Congruence ‘s – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.		
UNIT-V	CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS	9
Wilson‘s theorem – Fermat‘s little theorem – Euler‘s theorem – Euler‘s Phi functions – Tau and Sigma function		

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Apply Numerical methods to find the solutions of algebraic equations.
CO2	Work out numerical differentiation and numerical integration whenever routine methods are not applicable.
CO3	Prove results involving divisibility and greatest common divisors.
CO4	Find integral solutions to specified linear Diophantine equations.
CO5	Apply Wilson’s theorem and Fermat’s theorem to prove relations involving prime numbers.

TEXT BOOKS
1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015. 2. Koshy, T., ―Elementary Number Theory with Applications‖, Elsevier Publications, New Delhi, 2002.

Course Outcome	Mapping CO's with PO's														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	1	1
CO	3	3	**2**	**2**	1	-	-	-	-	-	-	1	3	1	1

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS521 / MOBILE COMPUTING			3	0	0	3

COURSE OBJECTIVES

- Recognize the basic concepts of mobile computing.
- Describe the basics of mobile telecommunication system.
- Diagnose the network layer protocols and Ad-Hoc networks.
- Build the basis of transport and application layer protocols.
- Demonstrate the 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, DECT, TETRA,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 Operating Systems, Software Development Kit: iOS, Android, BlackBerry, Windows Phone, M-Commerce, Structure, Pros & Cons, Mobile Payment System, Security Issues.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	State the basics of mobile telecommunication systems.
CO2	Illustrate the generations of telecommunication systems in wireless networks.
CO3	Reiterate the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
CO4	Discuss the functionality of Transport and Application layers.
CO5	Construct the 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 PrakashAgarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. UweHansmann, LotharMerk, 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, Tata McGraw Hill Edition ,2006.
4. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
5. Android Developers :http://developer.android.com/index.html .
6. Apple Developer :https://developer.apple.com/ .
7. Windows Phone Dev Center : http://developer.windowsphone.com.
8. BlackBerry Developer : http://developer.blackberry.com.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS52A / MOBILE APPLICATION LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ Build the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- ✓ Organize how to work with various mobile application development frameworks.
- ✓ Experiment the basic and important design concepts and issues of development of mobile applications.
- ✓ Demonstrate the capabilities and limitations of mobile devices

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	Write a mobile application that creates alarm clock in android.
13	Develop an android studio project to make a calendar.
14	Develop a Mobile application for simple needs (Mini Project).

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Design the mobile applications using GUI and Layouts.
CO2	Appraise mobile applications using Event Listener.
CO3	Practice the mobile applications using Databases.
CO4	Apply mobile applications using RSS Feed, Internal/External Storage, SMS, Multithreading and GPS.
CO5	Create the own mobile app for simple needs.

REFERENCES

1. "Build Your Own Security Lab", Michael Gregg, Wiley India, 2012.

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	1	-	-	-	-	-	-	3	2	-
CO2	3	3	3	3	3	1	-	-	-	-	-	-	3	2	-
CO3	3	3	3	3	3	3	-	-	-	-	-	-	3	2	-
CO4	3	3	3	3	3	1	-	-	-	-	-	-	3	2	-
CO5	3	3	3	3	3	1	-	-	-	-	-	-	3	2	-
CO	3	3	3	3	3	3	-	-	-	-	-	-	3	2	-

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	PROFESSIONAL COMMUNICATION			3	0	0	3

COURSE OBJECTIVES
➢ Develop their communicative competence in English with specific reference to Speaking and listening. ➢ Enhance their ability to communicate effectively in interviews. ➢ Strengthen their prospects of success in competitive examinations.

LIST OF EXPERIMENTS	
1	Letter Writing i. Formal letter ii. Informal letter
2	Report Writing i. Event report ii. Project report
3	Resume Writing
4	Non-Technical Presentation
5	Technical Presentation
6	Interview Skills
7	Group Discussion
8	Listening Comprehension
9	Reading Comprehension
10	Common Errors in English
Beyond the Syllabus	
1	Familiarize different Genres of texts.
2	Different types of speeches, debates and Model UN.

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	➢ Equip students with technology driven language skills required for successful undertaking of academic studies with primary emphasis on academic speaking and listening and to prepare students for competitive exams.
CO2	➢ Identify different genres of reading and writing, and be able to reflect and respond critically on formal communication such as letters, reports and memos.
CO3	➢ Learn to understand the role of multiple intelligences and incorporate them in communication in a diverse team.

CO-PO & PSO Mapping

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

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 system design 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, 2012Doughlas—Microprocessors and Interfacing, Programming and Hardware‖,TMH,2012

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191EC51A / MICROPROCESSORS AND MICROCONTROLLERS LABORATORY			3	0	0	3

COURSE OBJECTIVES
• To Introduce ALP concepts, features and Coding methods • Write ALP for arithmetic and logical operations in 8086 and 8051 • Differentiate Serial and Parallel Interface • Interface different I/Os with Microprocessors • Be familiar with MASM

LIST OF EXPERIMENTS	
	8086 Programs using kits and MASM
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	Printer status
12	Serial interface and Parallel interface A/D and D/A interface and Waveform G

13	A/D and D/A interface and Waveform G
	8051 Experiments using kits and MASM
14	Basic arithmetic and Logical operations
15	Square and Cube program, Find 2‘s complement of a number
16	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	Explain the difference between simulator and Emulator.

REQUIREMENTS FOR A BATCH OF 30 STUDENTS				
SI NO	**DESCRIPTION OF EQUIPMENT**	**QUANTITY REQUIRED**	**QUANTITY AVAILABLE(A)**	**DEFICIENCY(R-A)**
1	**HARDWARE:** 8086 development kits Interfacing Units Microcontroller	30	30	NIL
2	**SOFTWARE:** Intel Desktop Systems with MASM 8086 Assembler 8051 Cross Assembler	30	30	NIL

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

SEMESTER VI

Course Code	Name of the Course	Category	L	T	P	Credits
191IT621	Artificial Intelligence	PC	3	0	0	3
191CS621	Compiler Design	PC	3	0	0	3
191CS622	Internet Programming	PC	3	0	0	3
	Professional Elective - III	PE	3	0	0	3
	Open Elective - II	OE	3	0	0	3
191CS62A	**Compiler Design Laboratory**	PC	0	0	2	1
191CS62B	**Internet Programming Laboratory**	PC	0	0	2	1
191CS67A	**Miniproject**	PROJ	0	0	4	2
191MC66A	**Internship / Training - II**	MC	0	0	0	**
		Total	**15**	**0**	**8**	**19**

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS622 / INTERNET PROGRAMMING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand different Internet Technologies.
- ✓ To create and learn client side Programming
- ✓ To learn server side Programming
- ✓ To create php programming and Xml
- ✓ To learn java-specific web services architecture

SYLLABUS

UNIT-I	WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0	9

Web Essentials: Clients, Servers and Communication, The Internet, Basic Internet protocols, World wide web, HTTP Request Message, HTTP Response Message, Web Clients, Web Server, HTML5: Tables, Lists, Image, HTML5 control elements, Semantic elements, Drag and Drop, Audio, Video controls, CSS3: Inline, embedded and external style sheets, Rule cascading, Inheritance, Backgrounds, Border Images , Colors , Shadows , Text, Transformations, Transitions, Animations .Examples of Canvas.

UNIT-II	CLIENT SIDE PROGRAMMING	9

Java Script: An introduction to JavaScript, JavaScript DOM Model, Date and Objects, Regular Expressions, Exception Handling, Validation, Built-in objects, Event Handling, DHTML with JavaScript, JSON introduction, Syntax, Function Files, Http Request, SQL.Arrays

UNIT-III	SERVER SIDE PROGRAMMING	9

Servlets: Java Servlet Architecture, Servlet Life Cycle, Form GET and POST actions, Session Handling, Understanding Cookies, Installing and Configuring Apache Tomcat Web Server, DATABASE CONNECTIVITY : JDBC perspectives, JDBC program example , JSP: Understanding Java Server Pages, JSP Standard Tag Library (JSTL), Creating HTML forms by embedding JSP code. Mixing Scriplets and HTML

UNIT-IV	PHP and XML	9

An introduction to PHP: PHP, Using PHP, Variables, Program control, Built-in functions, Form Validation, Regular Expressions, File handling, Cookies, Connecting to Database. XML: Basic XML- Document Type Definition, XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).XMLXlink,Xpath Axes

UNIT-V	INTRODUCTION TO AJAX and WEB SERVICES	9

AJAX: Ajax Client Server Architecture, XML Http Request Object, Call Back Methods; Web Services: Introduction, Java web services Basics, Creating, Publishing, Testing and Describing a Web services (WSDL), Consuming a web service, Database Driven web service from an application, SOAP.Higher orderAJAX ASP Example

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Explain the basic web essential terms using HTML and Cascading Style Sheets.
CO2	Discuss the creation of dynamic web page with validation using Java Script objects.
CO3	Create the server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and represent data in XML format.
CO5	Develop AJAX , web services and various interactive web applications.

TEXT BOOKS

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program" , Prentice Hall, 5th Edition, 2011.

REFERENCES

1. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming , "Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J, "Web Technology" , Prentice Hall of India, 2011.
5. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	-	-	-	-	3	3	3	-	3	3	3	3
CO 2	3	3	3	-	-	-	-	3	3	3	-	3	3	3	3
CO 3	3	3	3	-	-	-	-	3	3	3	-	3	3	3	3
CO 4	3	3	3	-	-	-	-	3	3	3	-	3	3	3	3
CO 5	3	3	3	-	-	-	-	3	3	3	-	3	3	3	3
CO	3	3	3	-	-	-	-	3	3	3	-	3	3	3	3

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS621 / COMPILER DESIGN			3	0	0	3

COURSE OBJECTIVES

- ✓ Describe the various phases of compiler.
- ✓ Organize the various parsing techniques.
- ✓ Justify the intermediate code generation and run-time environment.
- ✓ Summarize the front-end of the compiler.
- ✓ Measure how to implement code generator.

SYLLABUS

UNIT-I	INTRODUCTION TO COMPILERS	9

Structure of a compiler, Lexical Analysis, Role of Lexical Analyzer, Input Buffering , Specification of Tokens , Recognition of Tokens, Lex, Finite Automata, NFA, Regular Expressions to Automata, Minimizing DFA.

UNIT-II	SYNTAX ANALYSIS	12

Role of Parser, Grammars, Error Handling, Context-free grammars , Writing a grammar, Top Down Parsing , General Strategies Recursive Descent Parser Predictive Parser, LL(1) Parser, Shift Reduce Parser, LR Parser, LR (0)Item Construction of SLR Parsing Table, Introduction to LALR Parser, CLR(1) Parser, Error Handling and Recovery in Syntax Analyzer, YACC.

UNIT-III	INTERMEDIATE CODE GENERATION	8

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

UNIT-IV	RUN-TIME ENVIRONMENT AND CODE GENERATION	8

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation , Design of a simple Code Generator.

UNIT-V	CODE OPTIMIZATION	8

Principal Sources of Optimization, Peep-hole optimization, DAG, Optimization of Basic Blocks, Global Data Flow Analysis, Efficient Data Flow Algorithm, Minimal List GNU for windows.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Acquire knowledge in different phases and passes of Compiler, and specifying different types of tokens by lexical analyzer.
CO2	Illustrate the translation of regular expression into parse tree using syntax analyzer and use the Compiler tools.
CO3	Practice about the top-down parsing and bottom-up parsing and able to construct parse table.
CO4	Able to translate the statement and implement the storage allocation strategies.
CO5	Analyze the various optimization techniques.

TEXT BOOKS

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers : Principles, Techniques and Tools", Second Edition, Pearson Education, 2009.

REFERENCES

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993.

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	2	2	1	1	-	1	1	1	3	2	-
CO2	3	3	3	2	2	2	2	1	-	1	1	2	3	-	2
CO3	3	3	3	2	2	2	2	-	-	1	1	2	3	2	2
CO4	3	3	3	2	2	2	1	-	-	1	1	2	3	2	-
CO5	3	3	3	2	2	2	1	1	-	1	1	2	3	2	2
CO	3	3	3	2	2	2	2	1	-	1	1	2	3	2	2

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS62B / INTERNET PROGRAMMING LABORATORY			0	0	2	1

COURSE OBJECTIVES

- ✓ To be familiar with Web page design using HTML/XML and style sheets.
- ✓ To learn to create dynamic web pages using server side scripting.
- ✓ To learn to write Client Server applications.
- ✓ To be familiar with the PHP programming.
- ✓ To be exposed to creating applications with AJAX.and Spring

LIST OF EXPERIMENTS	
1	Create a web page with the following using HTML a. To embed a map in a web page b. To fix the hot spots in that map c. Show all the related information when the hot spots are clicked.
2	Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages.
3	Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
4	Write programs in Java using Servlets: a. To invoke servlets from HTML forms b. Session tracking using hidden form fields and Session tracking for a hit count
5	Write programs in Java to create three-tier applications using servlets for conducting online examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
6	Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.
7	Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.
8	Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.
9	a. Validate the form using PHP regular expression. b. PHP stores a form data into database.

10	Write a web service for finding what people think by asking 500 people‘s opinion for any consumer product.
11	Create a Spring MVC application. The application should handle form validation, file upload, session tracking

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Explain the basic web essential terms using HTML and Cascading Style Sheets.
CO2	Discuss the creation of dynamic web page with validation using Java Script objects.
CO3	Create the server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and represent data in XML format.
CO5	Develop AJAX , web services and various interactive web applications.

SOFTWARE REQUIRED
Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS62A / COMPILER DESIGN LABORATORY			0	0	2	1

COURSE OBJECTIVES
➢ Build using different compiler writing tools. ➢ Diagnose how to implement the different Phases of compiler ➢ Express the familiarities how to use the control flow and data flow analysis ➢ Design the simple optimization techniques

LIST OF EXPERIMENTS	
1	Implementation of Symbol Table
2	Develop a lexical analyzer to recognize a few patterns in C.
3	Implementation of Lexical Analyzer using Lex Tool
4	Generate YACC specification for a few syntactic categories
5	Program to recognize a valid arithmetic expression that uses operator +, - , *
6	Program to recognize a valid variable which starts with a letter followed by any number of letters or digits
7	Implementation of Calculator using LEX and YACC
8	Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree
9	Implement type checking
10	Implement control flow analysis and Data flow Analysis
11	Implement any one storage allocation strategies(Heap,Stack,Static)
12	Construction of DAG
13	Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler.
14	Implementation of Simple Code Optimization Techniques

15	Implementation Of Shift-Reduced Parsing Algorithms
16	Construction Of LR -Parsing Table.
17	Construction of CLR –Parsing Table.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyse the different compiler writing tools to implement the different Phases.
CO2	Design the data flow and control flow.
CO3	Develop the intermediate representation.
CO4	Construct the back end of a compiler for 8086 assembler.
CO5	Compare various code optimization techniques.

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	2	1	-	-	-	-	1	3	3	2
CO2	3	3	3	3	2	1	-	-	-	-	-	1	3	3	1
CO3	3	3	3	3	2	1	-	-	-	-	-	1	3	3	1
CO4	3	3	3	3	3	1	-	-	1	-	-	1	3	3	1
CO5	3	3	3	3	2	1	1	-	-	-		1	3	3	1
CO	3	3	3	3	2	1	1	-	1	-	-	1	**3**	**3**	**1**

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.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Discuss agent types with its charchterstics.
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 for NLP that use Artificial Intelligence..

TEXT BOOKS

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

2 I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES

1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and 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 ISO Standard‖, 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 of Computational Agents‖, Cambridge University Press, 2012.

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

SEMESTER VII

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

COURSE OBJECTIVES
✓ To understand Cryptography Theories, Algorithms and Systems. ✓ To implement 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.		

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	Identify the commonly used cryptographic operations of public key cryptography.
CO4	Demonstrate the various Authentication schemes to simulate different applications.
CO5	Articulate various Security practices and System security standards.

TEXT BOOKS

1. William Stallings, " Cryptography and Network Security : Principles and Practice", PHI 3rd Edition, 2006.

REFERENCES

1. C K Shyamala, N Harini and Dr. T R Padmanabhan," Cryptography and Network Security", Wiley India Pvt.Ltd 2012.
2. BehrouzA.Foruzan, "Cryptography and Network Security", Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: PRIVATE Communication in a public World", Prentice Hall, ISBN 0-13-046019-2.

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
CO 1	3	2	2	1	-	-	-	-	-	-	1	-	2	2	1
CO 2	2	2	2	1	-	-	-	-	-	-	-	1	3	2	1
CO 3	3	2	2	2	-	-	-	-	-	-	1	-	2	2	1
CO 4	3	3	2	1	-	-	-	-	-	-	2	2	3	2	2
CO 5	3	2	2	1	-	-	-	-	-	-	2	1	2	1	1
CO	3	2	2	1	-	-	-	-	-	-	2	1	2	2	1

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS721 / CLOUD COMPUTING			3	0	0	3

COURSE OBJECTIVES

- ✓ To explain the concept of cloud computing.
- ✓ To appraise the evolution of cloud from the existing technologies.
- ✓ To apply knowledge on the various issues in cloud computing.
- ✓ To organize the various advances leading to security concerns.
- ✓ To design an emergence of cloud as the next generation computing paradigm.

SYLLABUS

UNIT-I	INTRODUCTION	8

Introduction to Cloud Computing, Definition of Cloud, Evolution of Cloud Computing -**Fundamental Cloud Architectures – Advanced Cloud Architectures - Specialized Cloud Architecture-** Underlying Principles of Parallel and Distributed Computing , Cloud Characteristics- Elasticity in Cloud -On demand provisoning

UNIT-II	CLOUD ENABLING TECHNOLOGIES	10

Service Oriented Architecture , REST and Systems of Systems , Web Services, Publish Subscribe Model , Basics of Virtualization , Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms , Virtualization of CPU, Memory, I/O Devices- Disaster Recovery-**Mobile Platform Virtualization**

UNIT-III	CLOUD ARCHITECTURE, SERVICES AND STORAGE	8

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-**A Case Study: The Grep TheWeb Application**

UNIT-IV	RESOURCE MANAGEMENT AND SECURITY IN CLOUD	10

Inter Cloud Resource Management , Resource Provisioning and Resource Provisioning Methods , Global Exchange of Cloud Resources- **Scheduling Algorithms for Computing Clouds - Resource Management and Dynamic Application Scaling** -Security Overview , Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards.

UNIT-V	CLOUD TECHNOLOGIES AND ADVANCEMENTS	8

Hadoop ,MapReduce , Virtual Box , Google App Engine, Programming Environment for Google App Engine . **Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.** - Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Discuss the architectural concepts, key technologies, strengths and limitations of cloud computing.
CO2	Apply the concept of virtualization in cloud technology
CO3	Analyze the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
CO4	Construct appropriate resource management and Security mechanism to bulid a cloud environment
CO5	Develop operation and economic models of various trending cloud platforms

TEXT BOOKS

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

REFERENCES

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

O-PO & PSO Mapping

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

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. playfair cipher, iii. Hill Cipher, iv. Vigenere cipher
2	Perform encryption and decryption using following transposition techniques i. Rail fence ii. row & Column Transformation
3	Apply DES algorithm for practical applications.
4	Apply AES algorithm for practical applications.
5	Implement RSA Algorithm using HTML and JavaScript.
6	Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7	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	Implement Block cipher using any one of the tool eg. Snort or any other s/w.
13	Case study: Electronic Mail security

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	Demonstrate the network security system using open source tools.

REFERENCES

1. " Build Your Own Security Lab", Michael Gregg, Wiley India 2013.

REQUIREMENTS FOR A BATCH OF 30 STUDENTS				
SI NO	**DESCRIPTION OF EQUIPMENT**	**QUANTITY REQUIRED**	**QUANTITY AVAILABLE(A)**	**DEFICIENCY(R-A)**
SOFTWARE				
1	C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent	30	30	NIL
HARDWARE				
2	Standalone desktops or server supporting 30 terminal or more	30	30	NIL

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
CO 1	3	2	1	1	-	-	-	-	-	-	2	1	2	1	1
CO 2	3	2	2	1	-	-	-	-	-	-	2	2	2	2	1
CO 3	3	3	2	1	-	-	-	-	-	-	1	1	2	1	1
CO 4	3	2	2	1	-	-	-	-	-	-	2	1	2	2	1
CO 5	2	2	1	1	-	-	-	-	-	-	2	2	1	1	1
CO	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**1**	**1**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS72A / CLOUD COMPUTING LABORATORY			0	0	2	1

COURSE OBJECTIVES
✓ To develop web applications in cloud ✓ To design and development process involved in creating a cloud based Application ✓ 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 windows 7 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 CloudSim and run a scheduling algorithm that is not present in CloudSim.
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 trystack (Online Openstack Demo Version)
8	Install Hadoop single node cluster and run simple applications like wordcount
9	Use gcc to compile c-programs. Split the programs to different modules and create an application using make command
10	Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories

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 a various scheduler
CO3	Design a web application in a 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

SOFTWARE REQUIRED

- ✓ A PC/Laptop with Oracle Virtual box 6.1.6
- ✓ VMware Workstation
- ✓ Google app engine
- ✓ Oracle Hadoop 3.2.1

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	1	1	1	-	-	-	-	-	-	-	2	2	2
CO 2	2	1	1	1	1	-	-	-	-	-	-	1	-	2	-
CO 3	2	1	1	1	1	1	-	-	1	-	-	1	2	-	2
CO 4	3	2	2	1	1	1	--	-	-	-	-	-	2	2	2
CO 5	2	1	1	1	1	1	1	-	-	-	-	-	2	2	1
CO	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**-**	**1**	**2**	**2**	**2**

SEMESTER VIII

SEMESTER V

PROFESSIONAL ELECTIVES - I

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS531 / 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**
Evolution of Big data, Best Practices for Big data Analytics, Big data characteristics, Validating, The Promotion Of the Value of Big Data, Big Data Use Cases, Characteristics of Big Data Applications, Perception and Quantification of Value, Understanding Big Data Storage, A General Overview of High-Performance Architecture, HDFS, Map Reduce and YARN Map Reduce Programming Model.		
UNIT-II	**CLUSTERING AND CLASSIFICATION**	**9**
Advanced Analytical Theory and Methods: Overview of Clustering, K-means, Use Cases, Overview of the Method, Determining the Number of Clusters, Diagnostics, Reasons to Choose and Cautions, Classification: Decision Trees, Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees in R, Naïve Bayes, Bayes‘ Theorem, Naïve Bayes Classifier.		
UNIT-III	**ASSOCIATION AND RECOMMENDATION SYSTEM**	**9**
Advanced Analytical Theory and Methods: Association Rules, Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, Finding Association& finding similarity, Recommendation System: Collaborative Recommendation, Content Based Recommendation, Knowledge Based Recommendation, Hybrid Recommendation Approaches.		
UNIT-IV	**STREAM MEMORY**	**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, Real time Analytics Platform (RTAP) applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics.		
UNIT-V	**NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION**	**9**
NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation, Key Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph Databases, Hive, Shading, Fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams, Analysing big data with twitter, Big data for E-Commerce Big data for blogs, Review of Basic Data Analytic Methods using R.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Describe the big data tools and its analysis techniques.
CO2	Identify the data by utilizing clustering and classification algorithms.
CO3	Apply different mining algorithms and recommendation systems for large volumes of data.
CO4	Analyze the data streaming methods
CO5	Investigate NoSQL databases and management

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/El sevier Publishers, 2013.

REFERENCES

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

CO-PO Mapping

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS533 / DIGITAL SIGNAL PROCESSING			3	0	0	3

COURSE OBJECTIVES
• To understand the basics of discrete time signals, systems and their classifications. • To analyze the discrete time signals in both time and frequency domain. • To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation. • To illustratre and interpret the Linear phase digital FIR filters using fourier method, window technique • To develop the concept and usage of DSP in various engineering fields.

SYLLABUS		
UNIT-I	**DISCRETE TIME SIGNALS AND SYSTEMS**	**9**
Introduction to DSP, Basic elements of DSP, Sampling of Continuous time signals, Representation, Operation and Classification of Discrete Time Signal, Classification of Discrete Time Systems, Discrete Convolution: Linear and Circular, Correlation.		
UNIT-II	**ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS**	**9**
Analysis of LTI Discrete Time Systems using DFT, Properties of DFT, Inverse DFT, Analysis of LTI - Discrete Time Systems using FFT Algorithms, Inverse DFT using FFT Algorithm.		
UNIT-III	**INFINITE IMPULSE RESPONSE FILTERS**	**9**
Frequency response of Analog and Digital IIR filters, Realization of IIR filter, Design of analog low pass filter, Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method, Design of digital IIR filters (LPF, HPF, BPF, and BRF) using various transformation techniques. FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Weiner Filter		
UNIT-IV	**FINITE IMPULSE RESPONSE FILTERS**	**9**
Linear Phase FIR filter, Phase delay–Group delay, Realization of FIR filter, Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRF) using Window method (Rectangular, Hamming window, Hanning window), Frequency Sampling Technique FIR Adaptive filters - Newton's steepest descent method		
UNIT-V	**APPLICATIONS OF DSP**	**9**
Multirate Signal Processing: Decimation, Interpolation, Sampling Rate conversion by a rational factor I/D Spectrum of the sampled signal, Processing of Audio and Radar signal..		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Learn the mathematical operations on signals.
CO2	Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
CO3	Transform the time domain signal into frequency domain signal and vice-versa.
CO4	Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.
CO5	Analyse the sampling rate conversion by a rational factor I/D spectrum of sampling signals and processing of audio and radar signals.

TEXT BOOKS

- John G. Proakis&DimitrisG.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.

REFERENCES

- Richard G. Lyons, "Understanding Digital Signal Processing". Second Edition, Pearson Education. 2004.
- A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
- Emmanuel C.Ifeachor, &Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
- William D. Stanley, "Digital Signal Processing", Second Edition, Reston Publications. 2002

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PS O1	PS O 2	PS O 3
CO1	3	2	2	1	-	-	1	-	-	-	-	-	3	2	1
CO2	3	2	2	1	-	-	1	-	-	-	-	-	3	2	1
CO3	3	2	2	1	-	-	1	-	-	-	-	-	2	2	1
CO4	3	2	2	1	-	-	1	-	-	-	-	-	3	2	1
CO5	3	2	2	1	-	-	1	-	-	-	-	-	3	2	1
CO	3	2	2	1	-	-	1	-	-	-	-	-	**3**	**2**	**1**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS534/GRAPH THEORY AND APPLICATIONS			3	0	0	3

COURSE OBJECTIVES
✓ To understand fundamentals of graph theory. ✓ To study proof techniques related to various concepts in graphs. ✓ To explore modern applications of graph theory.

SYLLABUS		
UNIT-I	INTRODUCTION	9
Introduction - Graph Terminologies - Types of Graphs - Sub Graph - Multi Graph, - Regular Graph, - Isomorphism -Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.		
UNIT-II	TREES AND CONNECTIVITY	9
Trees, Properties - Distance and Centers - Types - Rooted Tree - Tree Enumeration - Labeled Tree - Unlabeled Tree, Spanning Tree - Fundamental Circuits - Cut Sets - Properties - Fundamental Circuit and Cut-set – Connectivity and separability - Related Theorems.		
UNIT-III	PLANARITY	9
Network Flows - Planar Graph - Representation – Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph – Properties - Euler Digraph.		
UNIT-IV	MATRICES AND COLORING	9
Matrix Representation - Adjacency matrix - Incidence matrix - Circuit matrix - Cut-set matrix - Path Matrix Properties - Related Theorems – Correlations - Graph Coloring – Chromatic Polynomial - Chromatic Partitioning - Matching – Covering - Related Theorems.		
UNIT-V	GRAPH ALGORITHM AND SPANNING TREES	9
Graph Algorithms - Connectedness and Components - Spanning Tree - Fundamental Circuits - Cut Vertices Directed Circuits - Shortest Path - Applications overview.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define the basic concepts of graphs and different type of graphs.
CO2	Discuss the properties, theorem and able to prove theorems.
CO3	Apply suitable graph model and algorithm for solving applications.
CO4	Analyze the matrix representation of graphs and the related theorem.
CO5	Classify various graph algorithms and their applications.

TEXT BOOKS

1. Narsingh Deo, “Graph Theory with Application to Engineering and Computer Science”, Prentice-Hall of India Pvt. Ltd, 2003.
2. L.R. Foulds, “Graph Theory Applications”, Springer, 2016.

REFERENCES

1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication, 2008.
2. West, D. B., “Introduction to Graph Theory”, Pearson Education, 2011.
3. John Clark, Derek Allan Holton, “A First Look at Graph Theory”, World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer, 3rd Edition, 2006.
5. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", McGraw Hill, 2007.

CO- PO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	1	-	-	-	-
CO2	3	3	3	3	-	-	-	1	-	-	-	-
CO3	3	3	3	3	-	-	-	1	-	-	-	-
CO4	3	3	3	3	-	-	-	1	-	-	-	-
CO5	3	3	3	3	-	-	-	1	-	-	-	-
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS535 / INTELLECTUAL PROPERTY RIGHTS			3	0	0	3

COURSE OBJECTIVES

- ✓ To give an idea about IPR, about the origin and development of WIPO and TRIPS Agreement.
- ✓ To understand the knowledge of patents, copy right, trademarks, designs and information Technology Act.
- ✓ To get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements.
- ✓ To learn Digital Innovations and Developments as Knowledge Assets related to IP law and Cyber law
- ✓ To explain the importance of Intellectual property protection and emerging issues

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction to IPRs, Basic concepts and need for Intellectual Property, Patents, Copyrights, Geographical Indications, IPR in India and Abroad, Genesis and Development, the way from WTO to WIPO, TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations, Important examples of IPR.

UNIT-II	REGISTRATION OF IPRs	9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT-III	AGREEMENTS AND LEGISLATIONS	9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT-IV	DIGITAL PRODUCTS AND LAW	9

Digital Innovations and Developments as Knowledge Assets, IP Laws, Cyber Law and Digital Content Protection, Unfair Competition, Meaning and Relationship between Unfair Competition and IP Laws, Case Studies.

UNIT-V	ENFORCEMENT OF IPRs	9

Infringement of IPRs, Enforcement Measures, Emerging issues, Case Studies.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Ability to manage Intellectual Property portfolio to enhance the value of the firm.
CO2	Understand the knowledge of patents, copy right, trademarks, designs and information Technology Act.
CO3	Appreciate the policy applied to patents, copyrights and trademarks
CO4	Analyze the relationship between intellectual property law and Cyber Law
CO5	Apply ethical and professional issues which arise in the intellectual property law context

TEXT BOOKS

1. V. ScopleVinod, "Managing Intellectual Property", Prentice Hall of India pvt Ltd, 2012.

2. S. V. Satakar, "Intellectual Property Rights and Copy Rights", EssEss Publications, New Delhi, 2002.

REFERENCES

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

2. PrabuddhaGanguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

3. Edited by Derek Bosworth and Elizabeth Webster, "The Management of Intellectual Property", Edward Elgar Publishing Ltd., 2013.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS536/SOFTWARE TESTING			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn the criteria for test cases.
- ✓ To learn the design of test cases.
- ✓ To understand the needs of the testing.
- ✓ To Evaluate working products
- ✓ To apply test automation techniques

SYLLABUS

UNIT-I	INTRODUCTION	9

Testing as an Engineering Activity, Testing as a Process, Testing Maturity Model, Testing axioms, Basic definitions, Software Testing Principles, The Tester‘s Role in a Software Development Organization, Origins of Defects, Cost of defects, Defect Classes, The Defect Repository and Test Design, Defect Examples, Developer/Tester Support of Developing a Defect Repository.

UNIT-II	TEST CASE DESIGN STRATEGIES	9

Test case Design Strategies, Using Black Box Approach to Test Case Design, Boundary Value Analysis, Equivalence Class Partitioning, State based testing, Cause-effect graphing, Compatibility testing, user documentation testing, domain testing, Random Testing, Requirements based testing, Using White Box Approach to Test design, Test Adequacy Criteria, static testing vs structural testing, code functional testing, Coverage and Control Flow Graphs, Covering Code Logic, Paths, code complexity testing, Additional White box testing approaches, Evaluating Test Adequacy Criteria.

UNIT-III	LEVELS OF TESTING	9

The need for Levels of Testing, Unit Test, Unit Test Planning, Designing the Unit Tests, The Test Harness, Running the Unit tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, Scenario testing, Defect bash elimination System Testing, Acceptance testing, Performance testing, Regression Testing, Internationalization testing, Ad-hoc testing, Alpha, Beta Tests, Testing OO systems, Usability and Accessibility testing, Configuration testing, Compatibility testing, Testing the documentation, Website testing.

UNIT-IV	TEST MANAGEMENT	9

People and organizational issues in testing, Organization structures for testing teams, testing services, Test Planning, Test Plan Components, Test Plan Attachments, Locating Test Items, test management, test process, Reporting Test Results, Introducing the test specialist, Skills needed by a test specialist, Building a Testing Group, The Structure of Testing Group, The Technical Training Program.

UNIT-V	TEST AUTOMATION	9

Software test automation, skills 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. **Selenium tools**

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Design test cases suitable for a software development for different domains.
CO2	Identify suitable tests to be carried out.
CO3	Prepare test planning based on the document.
CO4	Document test plans and test cases designed.
CO5	Make use of the latest test tool for functional and performance testing.

TEXT BOOKS

1. SrinivasanDesikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.

2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com.

REFERENCES

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.

2. Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 1995.

3. Boris Beizer, "Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold, New York, 1990.

4. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	2	2	2	3	3	3	3	3	3	3
CO2	3	3	3	3	2	2	2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	2	2	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	2	2	2	2	3	3	3	3	3	3	3
CO5	3	3	3	3	2	2	2	2	3	3	3	3	3	3	3
CO	3	3	3	3	2	2	2	2	3	3	3	3	3	3	3

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS532 / COMPUTER GRAPHICS			3	0	0	3

COURSE OBJECTIVES
• To Gain knowledge about graphics hardware devices and software used. • To Understand the two dimensional graphics and their transformation • To provide the importance of technical ability and creativity within design practice • To design the two-dimensional graphics and their transformations and the three-dimensional graphics and their transformations. • To appreciate illumination and color models. • To become familiar with understand clipping techniques and Blender

SYLLABUS		
UNIT-I	**ILLUMINATION AND COLOR MODELS**	**9**
Light sources, basic illumination models, halftone patterns and dithering techniques; Properties of light, Standard primaries and chromaticity diagram; Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model; Colour selection. Output primitives, points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.		
UNIT-II	**TWO-DIMENSIONAL GRAPHICS**	**9**
Two dimensional geometric transformations, Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing, viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.		
UNIT-III	THREE-DIMENSIONAL GRAPHICS	**9**
Three dimensional concepts; Three dimensional object representations, Polygon surfaces, Polygon tables, Plane equations, Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations, Bezier curves and surfaces, B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations, Translation, Rotation, Scaling, composite transformations; Three dimensional viewing, viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.		
UNIT-IV	**MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING**	**9**
Multimedia basics, Multimedia applications, Multimedia system architecture, evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia databases. Compression and decompression, Data and file format standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies		
UNIT-V	**HYPERMEDIA**	**9**
Multimedia authoring and user interface, Hypermedia messaging, Mobile messaging, Hypermedia message component, Creating hypermedia message, Integrated multimedia message standards, Integrated document management, Distributed multimedia systems.CASE STUDY: BLENDER GRAPHICS Blender Fundamentals, Drawing Basic Shapes,Modelling, Shading & Textures		

COURSE OUTCOMES **On completion of the course, students will be able to**	
CO1	Define two dimensional graphics.
CO2	Design two dimensional transformations and three dimensional graphics
CO3	Apply two dimensional transformations and three dimensional graphics
CO4	Implement clipping techniques to graphics.
CO5	Outline types of Multimedia File Format and Design Basic 3d Scenes using Blender

TEXT BOOKS

- Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, (UNIT I – III)2007
- 2. Andleigh, P. K and KiranThakrar, "Multimedia Systems and Design‖, PHI, (UNIT IV,V)2003

REFERENCES

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, "Computer Graphics: Principles and Practice", 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers,2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, "Fundamentals of Computer Graphics", CRC Press, 2010.
6. William M. Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", McGraw Hill 1978. https://www.blender.org/support/tutorials/.

CO-PO & PSO Mapping

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

SEMESTER V

PROFESSIONAL ELECTIVES - II

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS537 / AGILE METHODOLOGIES			3	0	0	3

COURSE OBJECTIVES

- ✓ Understand an iterative, incremental development process leads to faster delivery of more useful software.
- ✓ Apply the principles and practices of extreme programming.
- ✓ Analyze the essence of agile development methods.
- ✓ Develop prototyping in the software process.
- ✓ Demonstration of Agile development and quality assurance.

SYLLABUS

UNIT-I	AGILE METHODOLOGY	9

The Agile Movement - A Five Minute Primer, Agile Values, Agile Practices, Agile Principles, Theories for Agile Management, Agile Software Development, Traditional Model vs. Agile Model, Classification of Agile Methods, Agile Manifesto and Principles, Agile Project Management, Agile Team Interactions, Ethics in Agile Teams, Agility in Design, Testing, Agile Documentations, Agile Drivers, Capabilities and Values

UNIT-II	AGILE PROCESSES	9

Lean Production, SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Dynamic Systems Development Method,Lean Software Development, Extreme Programming: Method Overview, Lifecycle, Work Products, Roles and Practices.

UNIT-III	AGILITY AND KNOWLEDGE MANAGEMENT	9

Agile Information Systems, Agile Decision Making, Earl_S Schools of KM, Institutional Knowledge Evolution Cycle, Development, Acquisition, Refinement, Distribution, Deployment, Leveraging, KM in Software Engineering, Managing Software Knowledge, Challenges of Migrating to Agile Methodologies, Agile Knowledge Sharing, Role of Story-Cards, Story-Card Maturity Model (SMM).

UNIT-IV	AGILITY AND REQUIREMENTS ENGINEERING	9

Impact of Agile Processes in RE, Current Agile Practices, Variance, Overview of RE Using Agile, Managing Unstable Requirements, Requirements Elicitation, Agile Requirements Abstraction Model, Requirements Management in Agile Environment, Agile Requirements Prioritization, Agile Requirements Modeling and Generation, Concurrency in Agile Requirements Generation.

UNIT-V	AGILITY AND QUALITY ASSURANCE	9

Agile Product Development, Agile Metrics, Feature Driven Development (FDD), Financial and Production Metrics in FDD, Agile Approach to Quality Assurance, Test Driven Development, Agile Approach in Global Software Development.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define the common characteristics of an agile development process.
CO2	Identify and contrast state of the practice agile methodologies.
CO3	Practice the impact of social aspects on software development success.
CO4	Design software project characteristics that would be suitable for an agile process.
CO5	Evaluate Software process improvement as an ongoing task for development teams.

TEXT BOOKS

1. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
2. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.

REFERENCES

1. Craig Larman, "Agile and Iterative Development: A Manager_s Guide", Addison-Wesley, 2004.
2. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 2007.

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	-	-	-	1	1	-	-	-	2	2	2
CO 2	3	2	2	1	-	-	-	1	1	-	1	1	2	2	2
CO 3	3	2	1	1	-	-	-	1	1	-	1	1	2	2	2
CO 4	3	2	1	1	-	-	-	1	1	1	-	1	3	3	3
CO 5	3	3	2	1	-	-	-	1	1	1	-	1	3	3	3
CO	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS538 / DISTRIBUTED SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the foundations of distributed systems.
- ✓ To learn issues related to clock Synchronization and the need for global state in distributed systems.
- ✓ To learn distributed mutual exclusion and deadlock detection algorithms.
- ✓ To understand the significance of agreement, fault tolerance and recovery protocols in distributed system.
- ✓ To learn the characteristics of peer-to-peer and distributed shared memory systems.

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges. A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications. Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.

UNIT-II	MESSAGE ORDERING & SNAPSHOTS	9

Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels. Remote procedure call,Event and Notification

UNIT-III	DISTRIBUTED MUTEX & DEADLOCK	9

Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport‘s algorithm,Ricart-Agrawala algorithm, Maekawa‘s algorithm, Suzuki–Kasami’s broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp‘s classification, Algorithms for the single resource model, the AND model and the OR model. Bankers Algorithm

UNIT-IV	RECOVERY & CONSENSUS	9

Check pointing and rollback recovery: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated checkpointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in synchronous systems with failures.

UNIT-V	P2P & DISTRIBUTED SHARED MEMORY	9

Peer-to-peer computing and overlay graphs: Introduction, Data indexing and overlays, Chord, Content addressable networks, Tapestry. Distributed shared memory: Abstraction and advantages, Memory consistency models, Shared memory Mutual Exclusion.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Elucidate the foundations and issues of distributed systems.
CO2	Understand the various synchronization issues and global state for distributed systems.
CO3	Comprehend the Mutual Exclusion and Deadlock detection algorithms in distributed systems.
CO4	Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
CO5	Relate the features of peer-to-peer and distributed shared memory systems.

TEXT BOOKS

1. Kshemkalyani, Ajay D, and MukeshSinghal, "Distributed computing: principles, algorithms, and systems" Cambridge University Press, 2011.

2. George Coulouris, Jean Dollimore and Tim Kind berg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.

REFERENCES

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.

2. MukeshSinghal and Niranjan G. Shivaratri, "Advanced concepts in operating systems", McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.

3. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.

4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.

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	2	1
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	2	1
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	2	1
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	2	1
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	2	1
CO	3	3	3	-	-	-	-	-	-	-	-	-	3	**2**	**1**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS539 / INTERNET OF THINGS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the fundamentals of IoT.
- ✓ To understand the concepts of IoT Architectures and smart objects in IoT
- ✓ To learn about the basics of IoT Protocols.
- ✓ To build simple IoT systems with Arduino and Raspberry Pi.
- ✓ To apply the concept of IoT 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 ARCHITECTURES	9

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, Smart Objects and Connecting Smart Objects.

UNIT-III	IoT PROTOCOLS	9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks.

UNIT-IV	DESIGN AND DEVELOPMENT	9

Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

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 - Amazon Web Services for IoT.

COURSE OUTCOMES On completion of the course, students will be able to	
CO1	Explain the concept of IoT.
CO2	Analyze various protocols for IoT.
CO3	Design a Portable of an IoT system using Rasperry Pi/Arduino.
CO4	Deploy an IoT application and connect to the cloud.
CO5	Analyze applications of IoT in real time scenario.

TEXT BOOKS

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

REFERENCES

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015

2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012 (for Unit 2).

3. Jan Ho¨ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.

5. Michael Margolis, Arduino Cookbook, “Recipes to Begin, Expand, and Enhance Your Projects”, 2nd Edition, O'Reilly Media, 2011.

https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS5310/MACHINE LEARNING TECHNIQUES			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the need for machine learning for various problem solving.
- ✓ To study the various supervised, semi-supervised and unsupervised learning algorithm in machine learning.
- ✓ To understand the latent trends in machine learning.
- ✓ To design appropriate machine learning algorithms for problem solving.

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction to Artificial Intelligence-Application of AI-Machine Learning-Machine Learning Life Cycle-applications-Types of machine learning Learning Problems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Eliminations, Inductive Bias, Decision Tree Learning, Representation, Algorithm, Heuristic Space Search.

UNIT-II	NEURAL NETWORKS AND GENETIC ALGORITHMS	9

Basics of Neural Networks-Neural network representation, History and cognitive basis of neural computation Neural Network Representation, Problem, Perceptrons, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis Space Search, Genetic Programming, Models of Evaluation and Learning.

UNIT-III	BAYESIAN AND COMPUTATIONAL LEARNING	9

Bayes Theorem, Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm, Probability Learning, Sample Complexity, Finite and Infinite Hypothesis, Mistake Bound Model.

UNIT-IV	INSTANT BASED LEARNING	9

K-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Function, Case Based Learning

UNIT-V	ADVANCED LEARNING	9

Learning Set of Rules, Sequential Covering Algorithm, Learning Rule Set, First Order Rules, Sets of First Order Rules, Induction on Inverted Deduction, Inverting Resolution, Analytical Learning, Perfect Domain Theories, Explanation Base Learning, FOCL Algorithm, Reinforcement Learning, Task, Q-Learning, Temporal Difference Learning, Deep Neural Networks.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Recall the learning techniques with this basic knowledge.
CO2	Define effectively neural network and genetic algorithm for appropriate applications.
CO3	Apply Bayesian techniques and derive effectively learning rules.
CO4	Analyze the different machine learning techniques.
CO5	Differentiate reinforcement and analytical learning techniques.

TEXT BOOKS
1.Tom M.Mitchell,"Machine Learning",McGraw-Hill Education(Indian Ed,2013.

REFERENCES
1. Ethem Alpaydin, " Intd. to Machine Learning", PHI Learning Pvt.Ltd.,2013. 2. T.Hastic, R. Tibshirani, J.H. Friedman, " The Elements of Statistical Learning",Springer,1st Edition,2001.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS5311/ SOFTWARE PROJECT MANAGEMENT			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the Software Project Planning and Evaluation techniques.
- ✓ To plan and manage projects at each stage of the software development life cycle (SDLC).
- ✓ To learn about the activity planning and risk management principles.
- ✓ To manage software projects and control software deliverables.
- ✓ To develop skills to manage the various phases involved in project management and people management.
- ✓ To deliver successful software projects that support organization‘s strategic goals.

SYLLABUS

UNIT-I	PROJECT EVALUATION AND PROJECT PLANNING	9

Importance of Software Project Management, Activities, Methodologies, Categorization of Software Projects, Setting objectives, Management Principles, Management Control, Project portfolio Management, Cost-benefit evaluation technology, Risk evaluation, Strategic program Management, Stepwise Project Planning.

UNIT-II	PROJECT LIFE CYCLE AND EFFORT ESTIMATION	9

Software process and Process Models, Choice of Process models, Rapid Application development, Agile methods, Dynamic System Development Method, Extreme Programming, Managing interactive processes, Basics of Software estimation, Effort and Cost estimation techniques, COSMIC Full function points, COCOMO II, a Parametric Productivity Model.

UNIT-III	ACTIVITY PLANNING AND RISK MANAGEMENT	9

Objectives of Activity planning, Project schedules, Activities, Sequencing and scheduling, Network Planning models, Formulating Network Model, Forward Pass & Backward Pass techniques, Critical path (CRM) method, Risk identification, Assessment, Risk Planning, Risk Management, PERT technique, Monte Carlo simulation, Resource Allocation, Creation of critical paths, Cost schedules.

UNIT-IV	PROJECT MANAGEMENT AND CONTROL	9

Framework for Management and control, Collection of data, Visualizing progress, Cost monitoring, Earned Value Analysis, Prioritizing Monitoring, Project tracking, Change control, Software Configuration Management, Managing contracts, Contract Management.

UNIT-V	STAFFING IN SOFTWARE PROJECTS	9

Managing people, Organizational behavior, Best methods of staff selection, Motivation, The Oldham – Hackman job characteristic model, Stress, Health and Safety, Ethical and Professional concerns, Working in teams, Decision making, Organizational structures, Dispersed and Virtual teams, Communications genres, Communication plans, Leadership.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand Project Management principles while developing software.
CO2	Gain extensive knowledge about the basic project management concepts, framework and the process models.
CO3	Obtain adequate knowledge about software process models and software effort estimation techniques.
CO4	Estimate the risks involved in various project activities.
CO5	Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
CO6	Learn staff selection process and the issues related to people management.

TEXT BOOKS

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

REFERENCES

1. Robert K. Wysocki, "Effective Software Project Management" – Wiley Publication, 2011.

2. Walker Royce, "Software Project Management", Addison-Wesley, 1998.

3. Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), Fourteenth Reprint 2013.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	191CS5312 / SPEECH PROCESSING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the fundamentals of the speech processing.
- ✓ Explore the various speech models.
- ✓ Gather knowledge about the phonetics and pronunciation processing.
- ✓ Perform wavelet analysis of speech.
- ✓ To understand the concepts of speech recognition.

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction, knowledge in speech and language processing, ambiguity, models and algorithms, language – thought, understanding, regular expression and automata, words & transducers, N grams.

UNIT-II	SPEECH MODELLING	9

Word classes and part of speech tagging, hidden markov model, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues, computing likelihood: the forward algorithm, training hidden markov model, maximum entropy model, transformation based tagging, evaluation and error analysis, issues in part of speech tagging, noisy channel model for spelling..

UNIT-III	SPEECH PRONUNCIATION AND SIGNAL PROCESSING	9

Phonetics, speech sounds and phonetic transcription, articulatory phonetics, phonological categories and pronunciation variation, acoustic phonetics and signals, phonetic resources, articulatory and gestural phonology.

UNIT-IV	SPEECH IDENTIFICATION	9

Speech synthesis, text normalization, phonetic analysis, prosodic analysis, diphone waveform synthesis, unit selection waveform synthesis, evaluation.

UNIT-V	SPEECH RECOGNITION	9

Automatic speech recognition, architecture, applying hidden markov model, feature extraction: mfcc vectors, computing acoustic likelihoods, search and decoding, embedded training, multipass decoding: n-best lists and lattices, a* ('stack') decoding, context-dependent acoustic models: triphones, discriminative training, speech recognition by human.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Create new algorithms with speech processing.
CO2	Derive new speech models.
CO3	Perform various language phonetic analysis.
CO4	Describe a new speech identification system.
CO5	Generate a new speech recognition system.

TEXT BOOKS

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Person education,2013.

REFERENCES

1. Kai-Fu Lee, "Automatic Speech Recognition", The Springer International Series in Engineering and Computer Science, 1999.

2. HimanshuChaurasiya, "Soft Computing Implementation of Automatic Speech Recognition", LAP Lambert Academic Publishing, 2010.

3. Claudio Becchetti, KlucioPrinaRicotti, "Speech Recognition: Theory and C++ implementation",Wiley publications 2008.

4. IkramiEldirawy ,WesamAshour, "Visual Speech Recognition", Wiley publications , 2011.

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

SEMESTER VI

PROFESSIONAL ELECTIVES - III

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS631 / ADHOC AND SENSOR NETWORKS			3	0	0	3

COURSE OBJECTIVES

- ✓ To Understand the ad hoc and sensor networks, protocols, and applications;
- ✓ To analyze the transport protocols for ad hoc networks and Qos solutions.
- ✓ To identify the working of MAC and Routing Protocols for ad hoc and sensor networks.
- ✓ To learn about the Transport Layer protocols and their QoS in Wireless sensor networks.
- ✓ To explain various security issues in ad hoc and sensor networks and the corresponding solutions

SYLLABUS

UNIT-I	MAC & ROUTING IN AD HOC NETWORKS	9

Introduction, Issues and challenges in ad hoc networks, MAC Layer Protocols for wireless ad hoc networks, Contention-Based MAC protocols, MAC Protocols Using Directional Antennas, Multiple-Channel MAC Protocols, Power-Aware MAC Protocols, Routing in Ad hoc Networks, Design Issues, Proactive, Reactive and Hybrid Routing Protocols.

UNIT-II	TRANSPORT & QOS IN AD HOC NETWORKS	9

TCP's challenges and Design Issues in Ad Hoc Networks, Transport protocols for ad hoc networks, Issues and Challenges in providing QoS, MAC Layer QoS solutions, Network Layer QoS solutions, QoS Model.

UNIT-III	MAC & ROUTING IN WIRELESS SENSOR NETWORKS	9

Introduction, Applications, Challenges, Sensor network architecture, MAC Protocols for wireless sensor networks, Low duty cycle protocols and wakeup concepts, Contention-Based protocols, Schedule-Based protocols, IEEE 802.15.4 Zigbee, Topology Control, Clustering, Time Synchronization, Sensor Tasking and Control, Routing Protocols.

UNIT-IV	TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS	9

Data-Centric and Contention-Based Networking, Transport Layer and QoS in Wireless Sensor Networks, Congestion Control in network processing, Operating systems for wireless sensor networks, Examples.

UNIT-V	SECURITY IN AD HOC AND SENSOR NETWORKS	9

Security Attacks, Key Distribution and Management, Intrusion Detection, Software based Anti-tamper techniques, Water marking techniques, Defense against routing attacks, Secure Ad hoc routing protocols, Broadcast authentication WSN protocols, TESLA, Biba, Sensor Network Security Protocols, SPINS, Sensor Network Platforms and Tools

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define different issues in wireless ad hoc and sensor networks.
CO2	Identify protocols developed for ad hoc and sensor networks.
CO3	Demonstrate the various ad hoc routing protocols and different categories of MAC protocols
CO4	Organize the issues of routing in wsn and QoS related performance measurements
CO5	Examine the security issues in ad hoc and sensor networks.

TEXT BOOKS

1. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2006.

2. Holger Karl, Andreas Willing, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Inc., 2005.

REFERENCES

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.

2. Carlos De MoraisCordeiro, Dharma PrakashAgrawal, "Ad Hoc and Sensor Networks: Theory and Applications", 2nd Edition, World Scientific Publishing, 2011.

3. WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons, 2010

4. Xiang-Yang Li, "Wireless Ad Hoc and Sensor Networks: Theory and Applications", 1227th edition, Cambridge university Press, 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	1	-	-	-	1	-	-	-	1	3	2	2
CO2	3	3	2	1	-	-	-	1	-	-	-	1	3	2	2
CO3	3	2	2	1	-	-	-	1	-	-	-	1	3	2	2
CO4	3	2	1	1	-	-	-	1	-	-	-	1	3	2	2
CO5	3	3	2	1	1	-	-	1	-	-	-	1	3	2	2
CO	3	3	**2**	**1**	**1**	**-**	**-**	**1**	-	-	-	1	3	2	2

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS632 / C# AND .NET PROGRAMMING			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn basic programming in C# and the object oriented programming concepts.
- ✓ To perform and enhance skills in writing Windows applications, ADO.NET and ASP.NET.
- ✓ To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
- ✓ To implement mobile applications using .Net compact framework
- ✓ To understand the working of base class libraries, their operations and manipulation of data using XML.

SYLLABUS

UNIT-I	C# LANGUAGE BASICS	9

Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts – Indexers.

UNIT-II	C# ADVANCED FEATURES	9

Delegates, Lambdas, Lambda Expressions, Events, Event Publisher, Event Listener, Strings and Regular Expressions, Generics, Collections, Memory Management and Pointers, Errors and Exceptions, Reflection.

UNIT-III	BASE CLASS LIBRARIES AND DATA MANIPULATION	9

Diagnostics, Tasks, Threads and Synchronization, .Net Security, Localization, Manipulating XML, SAX and DOM, Manipulating files and the Registry, Transactions, ADO.NET, Peer-to-Peer Networking, PNRP, Building P2P Applications, Windows Presentation Foundation (WPF).

UNIT-IV	WINDOW BASED APPLICATIONS, WCF AND WWF	9

Window based applications, Core ASP.NET, ASP.NET Web forms, Windows Communication Foundation (WCF), Introduction to Web Services, .Net Remoting, Windows Service, Windows Workflow Foundation (WWF), Activities, Workflows.

UNIT-V	.NET FRAMEWORK AND COMPACT FRAMEWORK	9

Assemblies, Shared assemblies, Custom Hosting with CLR Objects, App domains, Core XAML, Bubbling and Tunneling Events, Reading and Writing XAML, .Net Compact Framework, Compact Edition Data Stores, Errors, Testing and Debugging, Optimizing performance, Packaging and Deployment, Networking and Mobile Devices.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember various applications using C# Language in the .NET Framework.
CO2	Identify advanced features of .NET Framework.
CO3	Apply mobile applications using .NET compact Framework.
C04	Analyze web applications using a combination of client-side and server-side technologies.
C05	Evaluate experiment with the deployment of enterprise applications

TEXT BOOKS

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# 2012 and .NET 4.5", Wiley, 2012.

2. Harsh Bhasin, "Programming in C#", Oxford University Press, 2014.

REFERENCES

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, "Programming C# 4.0", O_Reilly, Fourth Edition, 2010.

2. Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework", Apress publication, 2012.

3. Andy Wigley, Daniel Moth, Peter Foot, "Mobile Development Handbook", Microsoft Press, 2011.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS633/DATA WAREHOUSING AND DATA MINING			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn data warehouse concepts, architecture, business analysis and tools.
- ✓ To understand data pre-processing and data visualization techniques.
- ✓ To study algorithms for finding hidden and interesting patterns in data.
- ✓ To apply and reproduce the various classification and clustering techniques using tools.

SYLLABUS

UNIT-I	DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICALPROCESSING (OLAP)	9

Basic Concepts - Data Warehousing Components, - Building a Data Warehouse, - Database Architectures for Parallel Processing - Parallel DBMS Vendors, Multidimensional Data Model, - Data Warehouse Schemas for Decision Support, - Concept Hierarchies, Characteristics of OLAP Systems - Typical OLAP Operations, - OLAP and OLTP.

UNIT-II	DATA MINING – INTRODUCTION	9

Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues,applications, Data Objects and attribute types, Statistical description of data, Data Preprocessing, Cleaning,Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilaritymeasures.

UNIT-III	DATA MINING - FREQUENT PATTERN ANALYSIS	9

Mining Frequent Patterns, Associations and Correlations, Mining Methods, Pattern Evaluation Method, Pattern Mining in Multilevel, MultiDimensional Space, Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT-IV	CLASSIFICATION AND CLUSTERING	9

Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Model Evaluation and Selection-Techniques to improve Classification Accuracy. **Forecasting models**: Heuristic methods, predictive modeling. Clustering Techniques, Cluster analysis-Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Evaluation of clustering, Clustering high dimensional data, Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT-V	WEKA TOOL	9

Datasets, Introduction, Iris plants database, Breast cancer database, Auto imports database, Introduction to WEKA, Weka 3 Data Mining SystemThe Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Learn about Data warehouse system and perform business analysis with OLAP tools.
CO2	Understand the suitable pre-processing and visualization techniques for data analysis.
CO3	Apply frequent pattern and association rule mining techniques for data analysis.
CO4	Analyse appropriate classification and clustering techniques for data analysis
CO5	Implements the Clustering techniques and algorithms for data analysis.

TEXT BOOKS

1. Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.

REFERENCES

1.Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw –Hill Edition,35th Reprint 2016.

2.K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data Mining Theory and Practice”, EasternEconomy Edition, Prentice Hall of India, 2006.

3.Ian H.Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Elsevier,Second Edition,2005.

CO-PO & PSO Mapping

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

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS634 / FUNDAMENTALS OF NANO SCIENCE			3	0	0	3

COURSE OBJECTIVES

- ✓ Define the basic fundamentals of Nano science
- ✓ Classify the general methods of preparation in Nano science
- ✓ Recognize the various forms of Nano materials
- ✓ Identify the techniques involved in Nano Science
- ✓ Summarize the various types of applications.

SYLLABUS

UNIT-I	INTRODUCTION	9

Nanoscale Science and Technology, Implications for Physics, Chemistry, Biology and Engineering, Classifications of nanostructured materials, nano particles, quantum dots, nanowires, ultra-thin films, multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT-II	GENERAL METHODS OF PREPARATION	9

Bottom-up Synthesis, Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT-III	NANOMATERIALS	9

Nanoforms of Carbon, Buckminster fullerene, graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT), methods of synthesis(arc growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays functionalization and applications - Quantum wires, Quantum dots-preparation, properties and applications.

UNIT-IV	CHARACTERIZATION TECHNIQUES	9

M based nanolithography and nanomanipulation, E beam lithography and SEM based nanolithography and nanomanipulation, Ion beam lithography, oxidation and metallization. Mask and its application, Deep UV lithography, X- ray based lithography

UNIT-V	APPLICATIONS	9

Nano InfoTech: Information storage, nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products, In Photostat, printing, solar cell, battery.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Explore the basic science of nanomaterials.
CO2	Discuss the preparation methods
CO3	Demonstrate the various forms of nanomaterials.
CO4	Develop the knowledge in characteristic nanomaterial.
CO3	Explain the applications of nanomaterial.

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.

2. N John Dinardo, "NanoscaleCharecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES

1. G Timp,"Nanotechnology", AIP press/Springer, 1999.

2. AkhleshLakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations", Prentice-Hall of India (P) Ltd, New Delhi, 2007.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	-	-	1	-	1	-	-	-	-	-	3	1	-
CO 2	3	2	2	1	1	-	1	-	-	-	-	-	3	2	1
CO 3	3	2	2	1	1	-	-	-	-	-	-	-	3	2	1
CO 4	3	2	2	2	2	-	1	-	-	-	1	-	3	2	1
CO 5	3	2	2	2	2	-	1	-	-	1	1	-	3	2	1
CO	**3**	**2**	**2**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**3**	**2**	**1**

EAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS635 /HUMAN COMPUTER INTERACTION			3	0	0	3

COURSE OBJECTIVES
✓ Define the foundations of Human Computer Interaction. ✓ Organize the design technologies for individuals and persons with disabilities. ✓ Identify the issues and models of HCI ✓ Summarize the concepts of mobile HCI. ✓ Recognize the guidelines for user interface.

SYLLABUS		
UNIT-I	FOUNDATIONS OF HCI	9
The Human: I/O channels, Memory, Reasoning and problem solving; The Computer: Devices, Memory, processing and networks; Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms, Case Studies		
UNIT-II	DESIGN & SOFTWARE PROCESS	9
Interactive Design: Basics, process, scenarios, navigation, screen design, Iteration and prototyping. HCI in software process: The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction		
UNIT-III	MODELS AND THEORIES	9
HCI Models: Cognitive models: Goal and task hierarchies Design Focus: GOMS saves money Linguistic Models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities. Socio-Organizational issues and stakeholder requirements, Communication and collaboration models, Hypertext, Multimedia and WWW.		
UNIT-IV	MOBILE HCI	9
Mobile Ecosystem: Platforms, Application frameworks, Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools, Case Studies.		
UNIT-V	WEB INTERFACE DESIGN	9
Designing Web Interfaces, Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow, Case Studies.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Design effective dialog for HCI.
CO2	Design effective HCI for individuals and persons with disabilities.
CO3	Assess the importance of user feedback.
CO4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO5	Develop meaningful user interface.

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)

2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)

3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009. (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
CO 1	3	3	2	2	2	1	1	1	-	-	2	2	2	3	2
CO 2	3	3	2	2	1	2	1	-	1	-	2	1	3	2	2
CO 3	3	3	3	2	2	-	-	-	1	-	2	2	2	2	2
CO 4	3	3	3	2	2	-	-	-	-	-	2	2	3	2	2
CO 5	3	3	3	2	2	2	-	-	-	-	2	2	3	2	2
CO	3	3	3	2	2	1	1	-	1	-	2	2	3	2	2

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS636 / INFORMATION RETRIEVAL TECHNIQUES			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the basics of Information Retrieval.
- ✓ To learn different modeling and retrieval evaluation for Information Retrievel.
- ✓ To understand machine learning techniques for text classification and clustering.
- ✓ To understand various search engine system operations.
- ✓ To learn different techniques of recommender system.

SYLLABUS

UNIT-I	INTRODUCTION	9

Information Retrieval, Early Developments, The IR Problem, The User's Task, Information versus Data Retrieval, The IR System, The Software Architecture of the IR System, The Retrieval and Ranking Processes, The Web, The e-Publishing Era, How the web changed Search, Practical Issues on the Web, How People Search, Search Interfaces Today, Visualization in Search Interfaces.

UNIT-II	MODELING AND RETRIEVAL EVALUATION	9

Basic IR Models, Boolean Model, TF-IDF (Term Frequency/Inverse Document Frequency) Weighting, Vector Model, Probabilistic Model, Latent Semantic Indexing Model, Neural Network Model, Retrieval Evaluation, Retrieval Metrics, Precision and Recall, Reference Collection, User-based Evaluation, Relevance Feedback and Query Expansion, Explicit Relevance Feedback.

UNIT-III	TEXT CLASSIFICATION AND CLUSTERING	9

A Characterization of Text Classification, Unsupervised Algorithms: Clustering, Naive Text Classification, Supervised Algorithms, Decision Tree, k-NN Classifier, SVM Classifier, Feature Selection or Dimensionality Reduction, Evaluation metrics, Accuracy and Error, Organizing the classes, Indexing and Searching, Inverted Indexes, Sequential Searching, Multi-dimensional Indexing.

UNIT-IV	WEB RETRIEVAL AND WEB CRAWLING	9

The Web, Search Engine Architectures, Cluster based Architecture, Distributed Architectures, Search Engine Ranking, Link based Ranking, Simple Ranking Functions, Learning to Rank, Evaluations, Search Engine Ranking, Search Engine User Interaction, Browsing, Applications of a Web Crawler, Taxonomy, Architecture and Implementation, Scheduling Algorithms, Evaluation.

UNIT-V	RECOMMENDER SYSTEM	9

Recommender Systems Functions, Data and Knowledge Sources, Recommendation Techniques, Basics of Content-based Recommender Systems, High Level Architecture, Advantages and Drawbacks of Content-based Filtering, Collaborative Filtering, Matrix factorization models, Neighborhood models.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Use an open source search engine framework and explore its capabilities.
CO2	Analyze different modeling for Information Retrievel.
CO3	Apply appropriate method of classification or clustering.
CO4	Demonstrate the entire process flow of a web search engine
CO5	Design and implement a recommender system.

TEXT BOOKS

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press Books, 2011.

2. Ricci, F, Rokach, L. Shapira, B.Kantor, "Recommender Systems Handbook", First Edition, 2011.

REFERENCES

1. C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.

2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 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
CO 1	3	2	1	-	1	-	-	-	-	-	-	-	2	2	1
CO 2	3	2	2	1	1	-	-	-	-	-	-	-	2	2	1
CO 3	3	2	1	1	1	-	-	-	-	-	-	-	2	2	1
CO 4	3	1	1	1	1	-	-	-	-	-	-	-	2	2	1
CO 5	3	1	1	-	1	-	-	-	-	-	-	-	2	2	1
CO	**3**	**2**	**1**	**1**	1	-	-	-	-	-	-	-	**2**	**2**	**1**

SEMESTER VII

PROFESSIONAL ELECTIVES – IV

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS731 / ADVANCED COMPUTER ARCHITECTURE			3	0	0	3

COURSE OBJECTIVES

- ✓ Understand the Concept of Parallel Processing and its applications.
- ✓ Implement the Hardware for Arithmetic Operations.
- ✓ Develop the performance of different scalar Computers.
- ✓ Analyze the Pipelining Concept for a given set of Instructions.
- ✓ Distinguish the performance of pipelining and non pipelining environment in a processor.

SYLLABUS

UNIT-I	FUNDAMENTALS OF COMPUTER DESIGN AND ILP	9

Fundamentals of Computer Design, Measuring and Reporting Performance, Instruction Level Parallelism and its Exploitation, Concepts and Challenges, Exposing ILP, Advanced Branch Prediction, Dynamic Scheduling, Hardware, Based Speculation, Exploiting ILP, Instruction Delivery and Speculation, Limitations of ILP, Multithreading

UNIT-II	MEMORY HIERARCHY DESIGN	9

Introduction, Optimizations of Cache Performance, Memory Technology and Optimizations, Protection: Virtual Memory and Virtual Machines, Design of Memory Hierarchies, Case Studies.

UNIT-III	MULTIPROCESSOR ISSUES	9

Introduction, Centralized, Symmetric and Distributed Shared Memory Architectures, Cache Coherence Issues, Performance Issues, Synchronization, Message-passing Mechanism,Models of Memory Consistency, Case Study-Interconnection Networks, Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT-IV	MULTICORE ARCHITECTURES	9

Homogeneous and Heterogeneous Multi-core Architectures, Intel Multicore Architectures, SUN CMP Architecture, IBM Cell Architecture. Introduction to Warehouse, scale computers, Architectures- Physical Infrastructure and Cost, Cloud Computing, the return of utility computing, Case Study- Google Warehouse-Scale Computer.

UNIT-V	VECTOR, SIMD AND GPU ARCHITECTURES	9

Introduction, Vector Architecture, SIMD Extensions for Multimedia, Graphics Processing Units, Case Studies, GPGPU Computing, Detecting and Enhancing Loop Level Parallelism, Case Studies.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand the concepts of parallelism in hardware/software.
CO2	Discuss memory organization and mapping techniques.
CO3	Demonstrate the salient features of different multicore architectures and how they exploit parallelism.
CO4	Apply the various techniques used for optimizing the cache performance.
CO5	Analyze the advanced computer architectures to solve complex engineering problems.

TEXT BOOKS

1. Kai Hwang, ‖Advanced Computer architecture Parallelism ,scalablity ,Programmablity ‖, Mc Graw Hill,N.Y, 2003
2. Kai Hwang and F.A.Briggs, ‖Computer architecture and parallel processor‖‘ Mc Graw Hill, N.Y, 1999

REFERENCES

1.Darryl Gove, “Multicore Application Programming : For windows, Linux and Oracle Solaris”, Pearson, 2011.

2.DavidB.Kirk, Wen-meiW.Hwu, “Programming Massively Parallel Processor”, Morgan Kauffman, 2010.

3.David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture : A hardware / software approach”, Morgan Kaufmann / Elsevier Publishers, 1999.

4.John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier, 5th Edition, 2012.

5. Kai Hwang and Zhi Wei Xu, “Scalable Parallel Computing”, Tata McGraw Hill, New Delhi, 2003.

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**
CO 1	3	3	2	1	-	-	-	-	-	-	1	1	3	2	2
CO 2	3	3	1	1	-	-	-	-	-	-	1	1	3	2	2
CO 3	3	2	2	1	-	-	-	-	-	-	1	1	3	2	2
CO 4	3	2	1	1	-	1	-	1	-	-	1	1	3	2	2
CO 5	3	3	2	1	-	1	-	1	-	-	1	1	3	3	2
CO	3	3	**2**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	1	1	3	2	2

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS735 / PRINCIPLES OF MANAGEMENT			3	0	0	3

COURSE OBJECTIVES
✓ To study the evolution, functions and principles of management. ✓ To understand the various planning tools and techniques. ✓ To learn the organization structures and get familiar with the responsibilities of Human Resource Management.

SYLLABUS		
UNIT-I	**INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS**	**9**
Definition of Management, Science or Art, Manager Vs Entrepreneur, types of managers, managerial roles and skills, Evolution of Management, Scientific, human relations , system and contingency approaches, Types of Business organization, Sole proprietorship, partnership, company-public and private sector enterprises, Organization culture and Environment, Current trends and issues in Management.		
UNIT-II	**PLANNING**	**9**
Nature and purpose of planning, planning process, types of planning, objectives, setting objectives, policies, Planning premises, Strategic Management, Planning Tools and Techniques, Decision making steps and process.		
UNIT-III	**ORGANISING**	**9**
Nature and purpose, Formal and informal organization, organization chart, organization structure, types, Line and staff authority, departmentalization, delegation of authority, centralization and decentralization, Job Design, Human Resource Management, HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management		
UNIT-IV	**DIRECTING**	**9**
Foundations of individual and group behaviour, motivation, Types and nature of motives, Theories of motivation and productivity, motivational techniques, job satisfaction, job enrichment, leadership, types and theories of leadership, communication, process of communication, barrier in communication, effective communication, communication and IT.		
UNIT-V	**CONTROLLING**	**9**
System and process of controlling, budgetary and non-budgetary control techniques, Design of control techniques, use of computers and IT in Management control, Productivity problems and management, control and performance, direct and preventive control, reporting.		

COURSE OUTCOMES	
CO1	Describe the basic of management and its types, skills, management roles, types of business organization and current trends in business.
CO2	Explain the nature and purpose of planning, types, objectives of planning and decision process.
CO3	Classify the different organization structures, authorities and responsibilities, human resource management and training and development.
CO4	Estimate the individual and group behavior, motivation, job satisfaction types and theories of leadership, communication and IT.
CO5	Discuss the process of controlling and use of computer and IT in management control and reporting.

TEXT BOOKS

1.Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.

2.JAF Stoner, Freeman R.E and Daniel R Gilbert, "Management", Pearson Education, 6th Edition, 2004.

REFERENCES

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management", Pearson Education,7th Edition, 2011.

2. Robert Kreitner&MamataMohapatra, "Management", Biztantra, 2008.

3. Harold Koontz & Heinz Weihrich,"Essentials of management", Tata McGraw Hill,1998.

4.Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO9	PO 10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	2	-	2	2	-	2	1	-	2	-
CO 2	3	3	3	3	2	2	-	2	-	-	2	1	-	3	-
CO 3	3	3	3	2	2	2	-	2	3	-	-	1	-	-	-
CO 4	3	3	3	2	1	1	-	1	3	3	-	1	-	-	-
CO 5	3	3	3	2	1	1	-	1	1	1	-	1	-	1	-
CO	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**1**	**-**	**2**	**-**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS732 / 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. Image Restoration - Degradation Model – Noise models - Spatial filtering – Frequency domain filtering.

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. Region based segmentation- Morphological processing- erosion and dilation.

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. Edge linking - Thresholding – Region based segmentation - Morphology.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Know the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
CO2	Understand on images using the techniques of smoothing, sharpening and enhancement.
CO3	Design the restoration concepts and filtering techniques.
CO4	Apply the basics of segmentation, features extraction, compression and recognition methods for color models.
CO5	Analyse data compression and Topological feature.

TEXT BOOKS

1.Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, Third Edition, 2010.

2.Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.

REFERENCES

1.Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.

2.Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing usingMATLAB", Pearson Education, Inc., 2011.

3.D.E. Dudgeon and RM. Mersereau, "Multidimensional Digital Signal Processing",PrenticeHall Professional Technical Reference, 1990.

4.William K. Pratt, "Digital Image Processing", John Wiley, New York, 2002.

5.MilanSonka et al, "Image processing, analysis and machine vision", Brookes/Cole, VikasPublishing House, 2nd edition, 1999.

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**
CO 1	3	2	2	2	-	-	-	1	-	1	-	-	-	-	1
CO 2	3	2	2	2	-	-	-	1	-	1	-	-	-	-	1
CO 3	3	2	2	2	-	-	-	1	-	1	-	-	-	-	1
CO 4	3	2	2	2	-	-	-	1	-	1	-	-	-	-	1
CO 5	3	2	2	2	-	-	-	1	-	1	-	-	-	-	1
CO	**3**	2	2	2	-	-	-	1	-	1	-	-	-	-	1

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS733 / EMBEDDED SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn the architecture and programming of ARM processor.
- ✓ To become familiar with the embedded computing platform design and analysis.
- ✓ To get thorough knowledge in interfacing concepts
- ✓ To design an embedded system and to develop programs

SYLLABUS

UNIT-I	INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS	9

Complex systems and microprocessors, Embedded system design process, Design example: Model train controller, Instruction sets preliminaries, ARM Processor, CPU: programming input and output- supervisor mode, exceptions and traps, Co-processors, Memory system mechanisms, CPU performance, CPU power consumption.

UNIT-II	EMBEDDED COMPUTING PLATFORM DESIGN	9

The CPU Bus-Memory devices and systems, Designing with computing platforms, consumer electronics architecture, platform-level performance analysis, Components for embedded programs, Models of programs, Assembly, linking and loading, compilation techniques, Program level performance analysis, Software performance optimization, Program level energy and power analysis and optimization, Analysis and optimization of program size, Program validation and testing.

UNIT-III	SENSOR INTERFACING WITH ARDUINO	9

Basics of hardware design and functions of basic passive components, sensors and actuators, Arduino code, library file for sensor interfacing, construction of basic applications.

UNIT-IV	EMBEDDED FIRMWARE	9

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT-V	EMBEDDED C PROGRAMMING	9

Introduction, Creating hardware delaysusing Timer 0 and Timer 1, Reading switches, Adding Structure to the code, Generating a minimum and maximum delay, Example: Creating a portable hardware delay, Timeout mechanisms, Creating loop timeouts, Testing loop timeouts, hardware timeouts, Testing a hardware timeout.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Describe the architecture and programming of ARM processor.
CO2	Interpret the concepts of embedded systems.
CO3	Analyze the Concepts of peripherals and interfacing of sensors.
CO4	Apply the system design techniques to develop firmware
CO5	Illustrate the code for constructing a system

TEXT BOOKS

1.Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (Unit I & II)

2. https://www.coursera.org/learn/interface-with-arduino#syllabus. (Unit III)

3.Michael J. Pont, "Embedded C", 2nd Edition, Pearson Education, 2008.(Unit IV & V)

REFERENCES

1.Shibu K.V, "Introduction to Embedded Systems", McGraw Hill, 2014

2.Jonathanw.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition, Cengage Learning, 2012.

3.Raj Kamal, "Embedded Systems – Architecture, Programming and Design", Third Edition, YmH 2015.

4.Lyla, "Embedded Systems", Pearson, 2013.

5.DavidE.Simon, "An Embedded Software Primer", 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**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**3**
CO 2	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**3**
CO 3	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**3**
CO 4	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**3**
CO 5	**3**	**3**	**3**	**2**	**1**	**1**	**1**					**2**	**3**	**3**	**3**
CO	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**3**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS734 / NATURAL LANGUAGE PROCESSING			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn the fundamentals of natural language processing
- ✓ To understand the use of CFG and PCFG in NLP
- ✓ To understand the role of semantics of sentences and pragmatics
- ✓ To apply the NLP techniques to IR applications

SYLLABUS

UNIT-I	INTRODUCTION	9

Origins and challenges of NLP - Language Modeling: Grammar -based LM, Statistical LM - Regular expressions, Finite-State Automata -Non-deterministic Finite Automation (NDFA) - English morphology, Types of morphemes – morphotactic – orthographic rules - Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT-II	WORD LEVEL ANALYSIS	9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of -Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging –Hidden Markov and Maximum Entropy models.

UNIT-III	SYNTACTIC ANALYSIS	9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT-IV	SEMANTICS AND PRAGMATICS	9

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT-V	DISCOURSE ANALYSIS AND LEXICAL RESOURCES	9

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Learn the given text with basic Language features.
CO2	Understand the use of different statistical approaches for different types of NLP applications.
CO3	Apply a rule based system to tackle morphology/syntax of a language.
CO4	Analyze a tag set to be used for statistical processing for real-time applications.
CO5	Design an innovative application using NLP components.

TEXT BOOKS

- ✓ Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language processing, Computational Linguistics and Speech, Pearson Publication, 2014.
- ✓ Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python‖, First Edition, O_Reilly Media, 2009.

REFERENCES

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Java‖, O_Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	-	-	-	-	1	1	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	1	1	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	1	1	-	-	-	-	-
CO4	3	2	3	2	-	-	-	-	1	1	-	-	-	-	-
CO5	3	3	2	1	-	-	-	-	1	1	-	-	--	-	-
CO	3	3	2	1	-	-	-		1	1	-	-	-	-	-

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS736/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 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-SOA, SOA Benefits, 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. Applications of web services.

UNIT-IV	WEB SERVICES EXTENSIONS	9

WS-Addressing, WS-Reliable Messaging, WS-Policy, WS-Coordination, WS – Transactions, WS-Security – Examples. Case study-Enterprise Application Integration (EAI)

UNIT-V	SERVICE ORIENTED ANALYSIS AND DESIGN	9

SOA delivery strategies, Service oriented analysis, Service Modeling, Service oriented design, Standards and composition guidelines, Service design, Business process design, Case Study.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Label XML technologies.
CO2	Identify service orientation, benefits of SOA.
CO3	Practice web services and WS standards.
CO4	Measure web services extensions to develop solutions.
CO5	Prepare and apply service modeling, service oriented analysis and design for application development.

TEXT BOOKS

1. ThomasErl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education-2005.

2. SandeepChatterjee 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. RonSchmelzer et al, "XML and Web Services", Pearson Education-2002.

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

CO-PO & PSO Mapping

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

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS737 / SOCIAL NETWORK ANALYSIS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the concept of semantic web and related applications.
- ✓ To learn knowledge representation using ontology.
- ✓ To understand human behaviour in social web and related communities.
- ✓ To learn visualization of social networks.
- ✓ To how networks evolve in time.

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction to Semantic Web: Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis: Development of Social Network Analysis, Key concepts and measures in network analysis, Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities, Web-based networks, Applications of Social Network Analysis.

UNIT-II	MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION	9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation, Ontology languages for the Semantic Web: Resource Description Framework, Web Ontology Language,Modelling and aggregating social network data: State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced representations.

UNIT-III	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Decentralized online social networks, multi-Relational characterization of dynamic social network communities.

UNIT-IV	PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	9

Understanding and predicting human behaviour for social communities, User data management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, Trust models based on subjective logic, Trust network analysis, Trust transitivity analysis, Combining trust and reputation, Trust derivation based on trust comparisons, Attack spectrum and countermeasures.

UNIT-V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	9

Graph theory, Centrality, Clustering, Node, Edge Diagrams, Matrix representation, Visualizing online social networks, Visualizing social networks with matrix-based representations, Matrix and Node-Link Diagrams, Hybrid representations, Applications, Cover networks, Community welfare, Collaboration networks, Co-Citation networks.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Develop semantic web related applications.
CO2	Represent knowledge using ontology.
CO3	Predict human behaviour in social web and related communities.
CO4	Visualize social networks.
CO5	Examine social networks analysis using case studies.

TEXT BOOKS

1. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.

2. BorkoFurht, “Handbook of Social Network Technologies and Applications”, 1st Edition, Springer, 2010.

REFERENCES

1. GuandongXu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking - Techniques and applications”, First Edition, Springer, 2011.

2. DionGoh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.

3. Max Chevalier, Christine Julien and Chantal Soule-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.

4. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 10**	**PO1 11**	**PO1 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	1	1	1	-	-	-	-	-	1	3	2	1
CO 2	3	3	2	1	1	1	-	-	-	-	-	1	2	2	1
CO 3	3	3	1	1	1	1	-	-	-	-	-	1	3	2	1
CO 4	3	3	3	1	1	1	-	-	-	-	-	1	2	1	2
CO 5	3	3	2	1	1	1	-	-	-	-	-	1	3	1	2
CO	**3**	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**	**1**

SEMESTER VII

PROFESSIONAL ELECTIVES – V

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS738 / CYBER FORENSICS			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn computerforensics
- ✓ To become familiar with forensicstools
- ✓ To learn to analyze and validate forensicsdata

SYLLABUS

UNIT-I	INTRODUCTION TO COMPUTER FORENSICS	9

Introduction to Traditional Computer Crime, Corporate IT Policy Formulations,Traditional problems associated with Computer Crime.Introduction to Digital Forensics , Introduction to Identity Theft & Identity Fraud. Types of CF techniques, Incident and incident response methodology, Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems , Understanding Computer Investigation, Data Acquisition.

UNIT-II	EVIDENCE COLLECTION AND FORENSICS TOOLS	9

Processing Crime and Incident Scenes, Working with Windows and DOS Systems. Current Computer Forensic Tools : Software / Hardware Tools,Windows Systems-FAT12, FAT16, FAT32 and NTFS.

UNIT-III	ANALYSIS AND VALIDATION	9

Validating Forensics Data, Data hiding Techniques, Performing Remote Acquisition, Network Forensics, Email Investigations, Cell Phone and Mobile Devices Forensics,Cyber attack protocols.

UNIT-IV	ETHICAL HACKING	9

Introduction TO Ethical Hacking, IP Theft ,Foot printing and Reconnaissance, Scanning Networks, Enumeration, System Hacking, Malware Threats, Sniffing.

UNIT-V	ETHICAL HACKING IN WEB	9

Introduction to International Laws on Ethical hacking, Social Engineering, Denial of Service, Session Hijacking, Hacking Web servers, Hacking Web Applications, SQL Injection, Hacking Wireless Networks, Hacking Mobile Platforms.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Provide the basics of computer forensics.
CO2	Identify the different computer forensic tools to a given scenario.
CO3	Analyze and validate forensics data.
CO4	Determine the vulnerabilities in a given network infrastructure.
CO5	Implement real-world hacking techniques to test system security.

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2016.

2. "CEH official Certified Ethical Hacking Review Guide", Wiley India Edition, 2015.

REFERENCES

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005.

2. MarjieT.Britz, "Computer Forensics and Cyber Crime: An Introduction", 3rd Edition, Prentice Hall, 2013.

3. AnkitFadia,"Ethical Hacking", Second Edition, Macmillan India Ltd, 2006.

4. Kenneth C.Brancik"Insider Computer Fraud",Auerbach Publications Taylor & Francis Group–2008.

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	-	-	-	-	-	-	2	1	2	1	1
CO2	3	2	2	1	-	-	-	-	-	-	-	1	2	2	1
CO3	3	3	2	1	-	-	-	-	-	-	2	1	1	1	-
CO4	2	2	1	1	-	-	-	-	-	-	2	2	2	2	1
CO5	3	3	2	1	-	-	-	-	-	-	2	1	2	1	1

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS739 / GRID AND CLOUD COMPUTING			3	0	0	3

COURSE OBJECTIVES

- Define how Grid computing helps in solving large scale scientific problems.
- Discuss on the concept of virtualization that is fundamental to cloud computing.
- Resolve the security issues in the grid and the cloud environment.
- Develop how to program the grid and the cloud.

SYLLABUS

UNIT-I	INTRODUCTION	9

Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers - Grid computing Infrastructures – cloud computing - service oriented architecture – Introduction to Grid Architecture and standards – Elements of Grid – Overview of Grid Architecture.- Metacomputing – the Precursor of Grid Computing, Scientific, Business and e-Governance Grids, Web Services and Grid Computing,

UNIT-II	GRID SERVICES	9

Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements –Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services- WSRF (Web Services Resource Framework), Resource Approach to Stateful Services, WSRF Specification.

UNIT-III	VIRTUALIZATION	9

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software - Pros and Cons of cloud computing – Implementation levels of virtualization – virtualization structure — virtual clusters and Resource Management – Desktop Virtualization Virtualization for data center automation- resource sharing and resource pooling

UNIT-IV	PROGRAMMING MODEL	9

Open source grid middleware packages – Globus Toolkit (GT4) Architecture , Configuration – Usage of Globus – Main components and Programming model - Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system- Hadoop Library from Apache -Mapping Applications - Programming Support.

UNIT-V	SECURITY	9

Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.- virtualization-based sandboxing; Storage Security- HIDPS, log management, Data Loss Prevention

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define the basic concepts of computing architecture and Recent Technologies
CO2	Describe the open standard services for Grid Architecture
CO3	Apply the concept of virtualization.
CO4	Develop the Grid and Cloud Tool Kit to program on it.
CO5	Demonstrate the security model in Grid and Cloud Environment

TEXT BOOKS

• Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

REFERENCES

1`.Jason Venner, "Pro Hadoop- Build Scalable, Distributed Applications in the Cloud", A Press, 2009

2. Tom White, "Hadoop The Definitive Guide", First Edition. O'Reilly, 2009

3. Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005

4. Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann

5. Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009

6. Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005

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
CO 1	3	3	3	1	-	-	-	-	-	-	-	1	1	1	1
CO 2	3	3	3	2	-	-	-	-	-	-	-	1	1	1	1
CO 3	3	3	3	2	-	-	-	-	-	-	-	1	1	1	1
CO 4	3	3	3	2	2	-	-	-	-	-	-	2	1	1	1
CO 5	3	3	3	2	3	-	-	-	-	-	-	2	1	1	1
CO	3	3	3	2	3	-	-	-	-	-	-	2	1	1	1

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS740 / INFORMATION SECURITY			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the basics of Information Security.
- ✓ To know the legal, ethical and professional issues in Information Security.
- ✓ To know the aspects of risk management.
- ✓ To become aware of various standards in this area.
- ✓ To know the technological aspects of Information Security.

SYLLABUS

UNIT-I	INTRODUCTION	9

History,What is Information Security? Security Management ,Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC,Indirect and Tracker Attacks.

UNIT-II	SECURITY INVESTIGATION	9

Need for Security, Security Policies,Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues, An Overview of Computer Security, Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

UNIT-III	SECURITY ANALYSIS	9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk, Systems: Access Control Mechanisms, Information Flow and Confinement Problem,Message Digest / Hash.

UNIT-IV	LOGICAL DESIGN	9

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT-V	PHYSICAL DESIGN	9

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel,Case study: PCI Data security Procedure

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Identify the basics of information security.
CO2	Illustrate the legal, ethical and professional issues in information security.
CO3	Demonstrate the aspects of risk management.
CO4	Analyze various standards in the Information Security System.
CO5	Design and implementation of Security Techniques.

TEXT BOOKS

1.Michael E Whitman and Herbert J Mattord, "Principles of Information Security‖, Vikas Publishing House, New Delhi, 2003.

REFERENCES

1.Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRCPress LLC, 2004.

2.Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed‖, Tata McGrawHill, 2003

3.Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	1	-	-	-	-	-	-	2	1	2	1	1
CO 2	3	3	2	1	-	-	-	-	-	-	2	2	2	2	1
CO 3	3	2	2	1	-	-	-	-	-	-	1	1	1	1	1
CO 4	3	3	2	2	-	-	-	-	-	-	2	1	2	2	1
CO 5	3	2	2	1	-	-	-	-	-	-	2	2	2	1	1
CO	**3**	**2**	**2**	**1**	-	-	-	-	-	-	**2**	**1**	**2**	**1**	**1**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS741/NEURAL NETWORKS AND DEEP LEARNING			3	0	0	3

COURSE OBJECTIVES
✓ To understand the various types of neural networks and their architectures. ✓ To analyze various deep un-supervised learning and memory models. ✓ To become familiar with natural language processing and interpret the application of deep learning in NLP.

SYLLABUS		
UNIT-I	**INTRODUCTION AND CONVOLUTION NEURAL NETWORKS**	**9**
Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, aka the vanishing gradient problem, and ways to mitigate it, RelU Heuristics for avoiding bad local minima- Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout, Convolutional Neural Networks, Architectures, convolution / pooling layers.		
UNIT-II	**RNN AND DEEP UNSUPERVISED LEARNING**	**9**
RNN- LSTM, GRU, Encoder Decoder architecture, Deep Unsupervised Learning: Auto encoders (standard, sparse, denoising, contractive, etc),Variational Auto encoders, Adversarial Generative Networks, Auto encoder and DBM.		
UNIT-III	**MEMORY MODELS**	**9**
Attention and Memory Models, Dynamic memory networks.		
UNIT-IV	**DEEP LEARNING IN COMPUTER VISION**	**9**
Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention models for computer vision tasks.		
UNIT-V	**DEEP LEARNING IN NLP**	**9**
Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of- Words model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning, Named Entity Recognition, Opinion Mining using Recurrent Neural Networks, Parsing and Sentiment Analysis using Recursive Neural Networks.		

COURSE OUTCOMES	
CO1	Design and implement convolution neural networks.
CO2	Identify various neural networks and their types.
CO3	Analyze various memory models.
CO4	Explain the different strategies and perspectives of deep learning fundamentals.
CO5	Interpret the application of deep learning in NLP.

TEXT BOOKS

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning” An MIT Press book, (2016).
2. Ethern Alpaydin, “Introduction to Machine Learning”, MIT Press book, (2014).
3. Li Deng and Ding Yu, “Deep Learning Methods and Applications” Now publishers, (2014).

REFERENCES

1. Abadi,Martin, etal, "Tensorflow: Large-scale machine learning on heterogeneous distributed systems" arXiv preprint arXiv:1603.04467 (2016).
2. Kumar, Ankit, et al, "Ask me anything: Dynamic memory networks for natural language processing" arXiv preprint arXiv:1506.07285 (2015).
3. Oquab, Maxime, etal, "Learning and transferring midlevel image representations using convolutional neural networks", Proceedings of the IEEE conference on computer vision and pattern recognition. (2014).
4. Kim, Yoon, "Convolutional neural networks for sentence classification." EMNLP (2014).
5. Collobert, Ronan, et al. "Natural language processing (almost) from scratch" Journal of Machine Learning Research 12thAug (2011): 2493-2537.

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**
CO 1	3	3	2	2	-	-	-	2	1	-	-	1	-	-	-
CO 2	3	3	2	2	2	2	-	2	2	-	-	1	-	-	-
CO 3	3	3	3	2	2	2	-	2	1	-	-	-	-	2	-
CO 4	3	3	3	3	2	2	-	2	1	-	-	-	-	2	-
CO 5	3	3	3	3	3	2	-	2	1	-	1	1	-	2	-
CO	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**1**	**-**	**1**	**1**	**-**	**2**	**-**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS742/ SOFT COMPUTING			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn the basic concepts of Soft Computing
- ✓ To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- ✓ To apply soft computing techniques to solve problems.
- ✓ Provide the mathematical background for carrying out the optimization associated with neural network learning.
- ✓ Aim of this course is to develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project.

SYLLABUS

UNIT-I	INTRODUCTION TO SOFT COMPUTING	9

Introduction, Artificial Intelligence, Artificial Neural Networks, Fuzzy Systems, Genetic Algorithm and Evolutionary Programming, Swarm Intelligent Systems, Classification of ANNs, McCulloch and Pitts Neuron Model, Learning Rules: Hebbian and Delta, Perceptron Network, Adaline Network, Madaline Network.

UNIT-II	ARTIFICIAL NEURAL NETWORKS	9

Back propagation Neural Networks, Kohonen Neural Network, Learning Vector Quantization, Hamming Neural Network, Hopfield Neural Network, Bi-directional Associative Memory, Adaptive Resonance Theory Neural Networks, Support Vector Machines, Spike Neuron Models.

UNIT-III	FUZZY SYSTEMS	9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Membership Functions, Defuzzification, Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning, Introduction to Fuzzy Decision Making.

UNIT-IV	GENETIC ALGORITHMS	9

Basic Concepts, Working Principles, Encoding, Fitness Function, Reproduction, Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators, Convergence of Genetic Algorithm.

UNIT-V	HYBRID SYSTEMS	9

Hybrid Systems, Neural Networks, Fuzzy Logic and Genetic, GA Based Weight Determination, LR-Type Fuzzy Numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Inference by Fuzzy BP, Fuzzy ArtMap: A Brief Introduction, Soft Computing Tools, GA in Fuzzy Logic Controller Design, Fuzzy Logic Controller.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Apply suitable soft computing techniques for various applications.
CO2	Integrate various soft computing techniques for complex problems.
CO3	Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems
CO4	Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations
CO5	Develop some familiarity with current research problems and research methods in Soft Computing Techniques.

TEXT BOOKS

1.N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", OxfordUniversity Press, 2015.

2.S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd.,2nd Edition, 2011.

3.S.Rajasekaran, G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and GeneticAlgorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, “Neuro-Fuzzy and Soft Computing”, PrenticeHall of India, 2002.

2. KwangH.Lee, “First course on Fuzzy Theory and Applications”,Springer, 2005.

3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1996.

4. James A. Freeman and David M. Skapura, “ Neural Networks Algorithms, Applications, andProgramming Techniques”, Addison Wesley, 2003.

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**
CO 1	3	2	1	1	1	1	-	-	1	-	-	1	3	2	1
CO 2	3	2	2	1	1	1	-	-	1	-	-	1	2	2	1
CO 3	3	2	1	1	1	1	-	-	1	-	-	1	3	2	1
CO 4	3	3	2	1	1	1	-	-	1	-	-	1	2	1	2
CO 5	3	3	2	1	1	1	-	-	1	-	-	1	3	1	2
CO	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**3**	**2**	**1**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS743/ SOFTWARE DEFINED NETWORK			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn the fundamentals of software definednetworks.
- ✓ To understand the separation of the data plane and the controlplane.
- ✓ To study about the SDNProgramming.
- ✓ To study about the various applications ofSDN.

SYLLABUS

UNIT-I	INTRODUCTION	9

History of Software Defined Networking (SDN), Modern Data Center, Traditional Switch Architecture, Why SDN, Evolution of SDN, How SDN Works, Centralized and Distributed Control and Date Planes.

UNIT-II	OPEN FLOW & SDN CONTROLLERS	9

Open Flow Specification, Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor, Based Overlays, SDN via Opening up the Device, SDN Controllers, General Concepts.

UNIT-III	DATA CENTERS	9

Multitenant and Virtualized Multitenant Data Center, SDN Solutions for the Data Center Network , VLANs, EVPN, VxLAN, NVGRE.

UNIT-IV	SDN PROGRAMMING	9

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs, Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

UNIT-V	SDN	9

Juniper SDN Framework, IETF SDN Framework, Open Daylight Controller, Floodlight Controller, Bandwidth Calendaring, Data Center Orchestration.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyze the evolution of software defined networks.
CO2	Express the various components of SDN and their uses.
CO3	Explain the use of SDN in the current networking scenario.
CO4	Design and develop various applications of SDN.
CO5	Describe Network Functions Virtualization components and their roles in SDN

TEXT BOOKS

1. PaulGoransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", First Edition, Morgan Kaufmann, 2014.

2. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.

REFERENCES

1. SiamakAzodolmolky, "Software Defined Networking with Open Flow", Packet Publishing, 2013.

2. Vivek Tiwari, "SDN and Open Flow for Beginners‖, Amazon Digital Services", Inc.,

2013.

3. Fei Hu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", CRC Press, 2014.

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 10	PO1 11	PO1 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	-	1	1	-	1	-	-	1	3	2	1
CO 2	3	2	2	1	-	1	1	-	1	-	-	1	2	2	1
CO 3	3	3	1	1	-	1	1	-	1	-	-	1	3	2	1
CO 4	3	2	2	1	-	1	1	-	1	-	-	1	2	1	2
CO 5	3	3	2	1	-	1	1	-	1	-	-	1	3	1	2
CO	**3**	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**1**	**3**	**2**	**1**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191HS701 / TOTAL QUALITY MANAGEMENT			3	0	0	3

COURSE OBJECTIVES
✓ To facilitate the understanding of Quality Management principles and process. ✓ To acquire knowledge on TQM Tools and Techniques ✓ To understand and implement the ISO standards

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, Customer focus, Customer orientation, Customer satisfaction, Customer complaints, Customer retention.		
UNIT-II	TQM PRINCIPLES	9
Leadership, Quality Statements, Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Team and Teamwork, 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, PERT Tools,Critical Path Method.		
UNIT-IV	TQM TOOLS AND TECHNIQUES II	9
Quality Circles, Cost of Quality, Quality Function Deployment (QFD), Taguchi quality loss function, TPM, Concepts, improvement needs,Performance measures.		
UNIT-V	QUALITY MANAGEMENT SYSTEM	9
Introduction, Benefits of ISO Registration, ISO 9000 Series of Standards, Sector-Specific Standards, AS 9100, TS16949 and TL 9000, ISO 9001 Requirements, Implementation, Documentation, Internal Audits, Registration, Environmental Management System: Introduction, ISO 14000 Series Standards, Concepts of ISO 14001, Requirements of ISO 14001, Benefits of EMS.		

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	Implement 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

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,HemantUrdhwaresheand RashmiUrdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES

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

2. Janakiraman. B and GopalR.K,"Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

4.ISO9001-2015 standards.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3

SEMESTER VIII

PROFESSIONAL ELECTIVES – VI

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS832 / GREEN COMPUTING			3	0	0	3

COURSE OBJECTIVES
✓ Knowledge of green computing practices to minimize negative impacts on the environment. ✓ Illustrate the Principles of green computing. ✓ Demonstrate Green Computing and how it can help improve environmental sustainability. ✓ Apply Green Computing in enterprises and its impact. ✓ Analyze green computing skills such as energy efficiency, IT assets disposal, carbon footprint estimation, reporting and development of green products.

SYLLABUS		
UNIT-I	**FUNDAMENTALS**	**9**
Green IT Fundamentals: Business, IT, and the Environment, Green computing: carbon foot print, scoop on power, Green IT Strategies: Drivers, Dimensions, and Goals, Energy-Saving Software Techniques,Environmentally Responsible Business: Policies, Practices, and Metrics.		
UNIT-II	**GREEN ASSETS AND MODELING**	**9**
Green Assets: Buildings, Data Centers, Networks, and Devices, Green Business Process Management: Modeling, Optimization, and Collaboration, Green Enterprise Architecture, Environmental Intelligence, Green Supply Chains, Green Information Systems: Design and Development Models.		
UNIT-III	**GRID FRAMEWORK**	**9**
Virtualization of IT systems, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Web, Temporal And Spatial Data Mining,Materials recycling, Best ways for Green PC, Green Data center, Green Grid framework.		
UNIT-IV	**GREEN COMPLIANCE**	**9**
Socio-cultural aspects of Green IT, Green Enterprise Transformation Roadmap,Green Compliance: Protocols, Standards, and Audits, Emergent Carbon Issues: Technologies and Future.		
UNIT-V	**CASE STUDIES**	**9**
The Environmentally Responsible Business Strategies (ERBS), Case Study Scenarios for Trial Runs, Case Studies, Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO2	Enhance the skill in energy saving practices in their use of hardware.
CO3	Apply technology tools that can reduce paper waste and carbon footprint by the stakeholders.
CO4	Analyze ways to minimize equipment disposal requirements .
CO5	Evaluate eco-friendly environment.

TEXT BOOKS

1.BhuvanUnhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press.

2.Woody Leonhard, Katherine Murray, "Green Home computing for dummies", August 2012.

REFERENCES

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shroff/IBM rebook.

2. John Lamb, "The Greening of IT", Pearson Education, 2009.

3. Jason Harris, "Green Computing and Green IT- Best Practices on regulations &industry", Lulu.com, 2008.

4. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.

5. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC 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	PSO 2	PSO 3
CO 1	3	3	2	1	-	-	-	1	-	-	-	1	3	2	2
CO 2	3	3	1	1	-	-	-	1	-	-	-	1	3	2	2
CO 3	3	2	2	1	-	-	-	1	-	-	-	1	3	2	2
CO 4	3	2	1	1	-	-	-	1	-	-	-	1	3	2	2
CO 5	3	3	2	1	-	-	-	1	-	-	1	1	3	2	2
CO	3	3	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	1	3	2	2

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS833 / INFORMATION THEORY AND CODING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the basics of information and coding theories.
- ✓ Be familiar with the various coding techniques for text, audio and speech type of data.
- ✓ To learn the various error control techniques for Convolutional codes
- ✓ To apply the different compression and decompression techniques.
- ✓ Learn the concepts of multimedia communication.

SYLLABUS

UNIT-I	INFORMATION ENTROPY FUNDAMENTALS	9

Uncertainty, Information and Entropy, Source coding Theorem, Huffman coding, Shannon Fano coding, Discrete Memory less channels, channel capacity, channel coding Theorem, Channel capacity Theorem.

UNIT-II	DATA AND VOICE CODING	9

Differential Pulse code Modulation, Adaptive Differential Pulse Code Modulation, Adaptive subband coding, Delta Modulation, Adaptive Delta Modulation, Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT-III	ERROR CONTROL CODING	9

Linear Block codes, Syndrome Decoding, Minimum distance consideration, cyclic codes, Generator Polynomial, Parity check polynomial, Encoder for cyclic codes, calculation of syndrome, Convolutional codes.

UNIT-IV	COMPRESSION TECHNIQUES	9

Principles, Text compression, Static Huffman Coding, Dynamic Huffman coding, Arithmetic coding, Image Compression, Graphics Interchange format, Tagged Image File Format, Digitized documents, Introduction to JPEG standards.

UNIT-V	AUDIO AND VIDEO CODING	9

Linear Predictive coding, code excited LPC, Perceptual coding, MPEG audio coders, Dolby audio coders, Video compression, Principles, Introduction to H.261 & MPEG Video standards.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Understand the basics of information and coding theories.
CO2	Discuss the various coding techniques for text, audio and speech type of data
CO3	Describe the various error control techniques for Convolutional codes
CO4	Apply the different compression and decompression techniques.
CO5	Apply the concepts of multimedia communication

TEXT BOOKS

1. SimonHaykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2001.

2. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education Asia, 2002

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

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
CO 1	3	2	1	1	-	-	-	-	-	-	-	1	2	-	-
CO 2	2	1	1	1	-	-	-	-	-	-	-	-	2	-	-
CO 3	3	2	1	1	-	-	-	-	1	-	-	-	3	-	-
CO 4	3	2	1	1	-	-	-	1	1	-	1	1	2	1	-
CO 5	3	2	1	1	-	-	-	1	1	-	1	1	2	1	1
CO	**3**	**2**	**1**	**1**				**1**	**1**		**1**	**1**	**2**	**1**	**1**

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS834 / MULTICORE ARCHITECTURE AND PROGRAMMING			3	0	0	3

COURSE OBJECTIVES
✓ To study the need for multi-core processors, and their architecture. ✓ To understand the challenges in parallel and multi-threaded programming. ✓ To learn about the various parallel programming paradigms. ✓ To develop multicore programs and design parallel solutions.

SYLLABUS		
UNIT-I	**MULTI-CORE PROCESSORS**	**9**
Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.		
UNIT-II	**PARALLEL PROGRAM CHALLENGES**	**9**
parallel architectural classification schemes-speedup performance laws- -Program and Network Properties-H/W-S/W Parallelism - Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).		
UNIT-III	**SHARED MEMORY PROGRAMMING WITH OpenMP**	**9**
shared memory model – message passing model - OpenMP Execution Model – Memory Model — OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.		
UNIT-IV	**DISTRIBUTED MEMORY PROGRAMMING WITH MPI**	**9**
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation		
UNIT-V	**PARALLEL PROGRAM DEVELOPMENT**	**9**
Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.- parallel simulations – parallel programming environment		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Describe multicore architectures and identify their characteristics and challenges. .
CO2	Identify the issues in programming Parallel Processors.
CO3	Apply the programs using OpenMP and MPI.
CO4	Analyze the programming for serial processors and programming for parallel Processors
CO5	Design parallel programming solutions to common problems.

TEXT BOOKS

1. Peter S. Pacheco, ―An Introduction to Parallel Programming‖, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, ―Multicore Application Programming for Windows, Linux, and Oracle Solaris‖, Pearson, 2011 (unit 2)

REFERENCES

1. Michael J Quinn, ―Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill,2003.
2. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
3. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

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	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	1	1	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	1	1	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	1	1	-	-	-	-	-	-	-
CO5	3	3	2	1	-	-	1	1	-	-	-	-	-	-	-

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191HS801 / PROFESSIONAL ETHICS IN ENGINEERING			3	0	0	3

COURSE OBJECTIVES

- ✓ To enable the students to create an awareness on Engineering Ethics and Human Values.
- ✓ To install Moral and Social Values and Loyalty
- ✓ To appreciate the rights of others.

SYLLABUS

UNIT-I	HUMAN VALUES	10

Morals, values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self confidence, Character, Spirituality, Introduction to Yoga and meditation for professional excellence and stress management, 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	8

Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Moral Leadership, Code of Conduct, Corporate Social Responsibility,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	Discuss 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, New Delhi, 2003.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, 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, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

5. Laura P. Hartman and Joe Desjardins,"Business Ethics: Decision Making for Personal Integrity and Social Responsibility",McGraw Hill education, India Pvt. Ltd.,New Delhi, 2013.

6. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011.

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	191CS836/REAL TIME SYSTEMS			3	0	0	3

COURSE OBJECTIVES
✓ To learn real time operating system concepts, the associated issues & Techniques. ✓ To understand design and synchronization problems in Real Time System. ✓ To explore the concepts of real time databases. ✓ To develop and evaluation techniques present in Real Time System.

SYLLABUS		
UNIT-I	REAL TIME SYSTEM AND SCHEDULING	9
Introduction, Structure of a Real Time System, Task classes, Performance Measures for Real Time Systems, Estimating Program Run Times, Issues in Real Time Computing, Task Assignment andScheduling, Classical uniprocessor scheduling algorithms, Fault Tolerant Scheduling.		
UNIT-II	SOFTWARE REQUIREMENTS ENGINEERING	9
Requirements engineering process, types of requirements, requirements specification for real time systems, Formal methods in software specification, Structured Analysis and Design, object oriented nalysis and design and unified modeling language, organizing the requirements document, organizing and writing documents, requirements validation and revision.		
UNIT-III	INTERTASK COMMUNICATION AND MEMORY MANAGEMENT	9
Buffering data, Time relative Buffering, Ring Buffers, Mailboxes, Queues, Critical regions, Semaphores, Other Synchronization mechanisms, deadlock, priority inversion, process stack management, run time ring buffer, maximum stack size, multiple stack arrangement, memory management in task control block, swapping, overlays, Block page management, replacement algorithms, memory locking, working sets, real time garbage collection, contiguous file systems.		
UNIT-IV	REAL TIME DATABASES	9
Real time Databases, Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time Systems.		
UNIT-V	EVALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION	9
Reliability Evaluation Techniques, Obtaining parameter values, Reliability models for Hardware Redundancy, Software error models. Clock Synchronization, Clock, A Nonfault – Tolerant Synchronization Algorithm, Impact of faults, Fault Tolerant Synchronization in Hardware, Fault Tolerant Synchronization in software.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember Real-time scheduling and schedulability analysis, including clock-driven and priority-driven scheduling
CO2	Identify the Theoretical background (specification/verification) and practical knowledge of real-time operating systems
CO3	Apply the use of multitasking techniques in real time systems, understand the fundamental concepts of real-time operating systems and memory management
CO4	Analyze the evaluation techniques present in Real Time System data base
CO5	Evaluate and compare types and Functionalities in commercial OS, application development using RTOS

TEXT BOOKS

C.M. Krishna, Kang, G.Shin, "Real Time Systems", McGraw Hill, 1997.
Herma K., "Real Time Systems – Design for distributed Embedded Applications", Kluwer Academic, 1997

REFERENCES

1. Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003
2. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,1997
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill,2006
4. Karim Yaghmour, Building Embedded Linux System",O'reilly Pub,2003

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
CO 1	3	2	1	1	-	-	-	-	-	-	-	2	2	1	1
CO 2	3	1	1	1	-	-	-	-	-	2	1	2	2	1	2
CO 3	3	2	1	1	1	1	1	-	-	2	1	2	2	1	1
CO 4	3	2	2	1	1	1	1	2	1	3	1	2	3	2	2
CO 5	3	2	2	2	1	1	1	2	1	3	1	2	3	2	2
CO	3	1	1	1	1	1	1	2	1	2	1	2	2	1	1

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS831 / GPU ARCHITECTURE AND PROGRAMMING			3	0	0	3

COURSE OBJECTIVES

- ✓ Define the basics of GPU architectures.
- ✓ Describe the applications of CUDA programming.
- ✓ Classify the issues in mapping algorithms for GPUs.
- ✓ Recognize the basic concepts of OPENCL
- ✓ Identify the different GPU programming models.

SYLLABUS

UNIT-I	GPU ARCHITECTURE	9

Evolution of GPU architectures, Understanding Parallelism with GPU, Typical GPU Architecture, CUDA Hardware Overview, Threads, Blocks, Grids, Warps, Scheduling, Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.CASE STUDY: Applications of GPU Architecture like Gaming, Computer Vision, etc.

UNIT-II	CUDA PROGRAMMING	9

Using CUDA, Multi GPU, Multi GPU Solutions, Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT-III	PROGRAMMING ISSUES	9

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues,Finding and Avoiding Errors.

UNIT-IV	OPENCL BASICS	9

Introduction to OpenCL – OpenCL Device Architectures – Basic OpenCL – examples – Understanding OpenCL – Concurrency and Execution Model – Dissecting a CPU/GPU – OpenCL Implementation – OpenCL.

UNIT-V	ALGORITHMS ON GPU	9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Describe GPU Architecture.
CO2	Construct programs using CUDA, identify issues and debug them.
CO3	Implement efficient algorithms in GPUs for common application kernels.
CO4	Explain simple programs using OpenCL.
CO5	Identify efficient parallel programming patterns to solve problems.

TEXT BOOKS

1. Shane Cook, CUDA Programming: ”A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)”, First Edition, Morgan Kaufmann, 2012.

2. David R. Kaeli, PerhaadMistry, Dana Schaa, Dong Ping Zhang, “Heterogeneous computing with OpenCL”, 3rd Edition, Morgan Kauffman, 2015.

REFERENCES

1. Nicholas Wilt, “CUDA Handbook: A Comprehensive Guide to GPU Programming”, Addison - Wesley, 2013.

2. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General Purpose GPU Programming”, Addison - Wesley, 2010.

3. David B. Kirk, Wen-mei W. Hwu, ”Programming Massively Parallel Processors - A Hands-on Approach”, Third Edition, Morgan Kaufmann, 2016.

4. http://www.nvidia.com/object/cuda_home_new.html.

5. http://www.openCL.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**
CO 1	3	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO 2	3	3	2	1	1	-	-	-	-	1	1	-	3	2	1
CO 3	3	3	2	2	1	-	-	-	-	1	-	-	3	2	1
CO 4	3	3	2	2	1	-	-	-	-	1	-	-	3	2	1
CO 5	3	3	2	2	2	-	1	-	1	1	-	-	3	2	2
CO	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**2**	**1**

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE	191CS836/PARALLEL ALGORITHMS			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand different parallel architectures and models of computation.
- ✓ To introduce the various classes of parallel algorithms.
- ✓ To study parallel algorithms for basic problems.

SYLLABUS

UNIT-I	INTRODUCTION	9

Need for Parallel Processing, Data and Temporal Parallelism, Models of Computation, RAM and PRAM Model, Shared Memory and Message Passing Models, Processor Organizations, PRAM Algorithm, Analysis of PRAM Algorithms, Parallel Programming Languages.

UNIT-II	PRAM ALGORITHMS	9

Parallel Algorithms for Reduction, Prefix Sum, List Ranking, Preorder Tree Traversal, Searching, Sorting, Merging Two Sorted Lists, Matrix Multiplication, Graph Coloring, Graph Searching.

UNIT-III	SIMD ALGORITHMS -I	9

2D Mesh SIMD Model, Parallel Algorithms for Reduction, Prefix Computation, Selection, Odd-Even Merge Sorting, Matrix Multiplication.

UNIT-IV	SIMD ALGORITHMS -II	9

Hypercube SIMD Model, Parallel Algorithms for Selection, Odd-Even Merge Sort,Bitonic Sort, Matrix Multiplication Shuffle Exchange SIMD Model, Parallel Algorithms for Reduction, Bitonic Merge Sort, Matrix Multiplication, Minimum Cost Spanning Tree.

UNIT-V	MIMD ALGORITHMS	9

MIMD Architecture, Structure of shared memory and distribution memory architecture in MIMD Architecture, UMA Multiprocessor Model, Parallel Summing on Multiprocessor, Matrix Multiplication on Multiprocessors and Multi-computer, Parallel Quick Sort, Mapping Data to Processors.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Summarize the need for parallel processing and the usage of various parallel algorithms.
CO2	Compare the efficiency of PRAM algorithm with different applications.
CO3	Design SIMD algorithm for various applications.
CO4	Explain the SIMD algorithm Models.
CO5	Describe the MIMD algorithm and its architecture.

TEXT BOOKS

1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.
3. Ellis Horowitz, SartajSahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition, 2011.

REFERENCES

1. M Sasikumar, Dinesh Shikhare and P Ravi Prakash, “Introduction to Parallel Processing”, PHI learning, 2013.
2. AnanthGrame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.
3. .S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

CO-PO & PSO Mapping Parallel Algorithm

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
CO 1	3	3	3	3	2	-	-	-	1	-	-	1	1	-	1
CO 2	3	3	3	3	2	-	-	1	1	-	-	1	3	2	1
CO 3	3	3	3	2	2	-	2	1	1	-	-	1	3	2	1
CO 4	3	3	3	3	2	2	2	1	1	-	-	1	3	2	1
CO 5	3	3	3	3	2	2	2	1	1	-	-	1	3	2	1
CO	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**1**	**3**	**2**	**1**