



दिल्ली प्रौद्योगिकी विश्वविद्यालय
DELHI TECHNOLOGICAL UNIVERSITY
(Formerly Delhi College of Engineering)

(Estd. By Govt. of NCT of Delhi vide Act 6 of 2009)



SCHEME OF TEACHING AND EXAMINATIONS
BACHELOR OF TECHNOLOGY
COMPUTER ENGINEERING

W.E.F 2015

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examinations
B. Tech. (COMPUTER ENGINEERING)
W.E.F. 2015



DELHI TECHNOLOGICAL UNIVERSITY
(Formerly Delhi College of Engineering)

CONTENTS

Delhi Technological University	COE-4
• Vision	COE-4
• Mission	COE-4
Department of Computer Science and Engineering	COE-5
• Vision	COE-5
• Mission	COE-5
Program Educational Objectives	COE-6
Scheme of Teaching and Examination	COE-7
List of Departmental Electives	COE-12
List of Open Electives	COE-14
Syllabus	COE-16
Syllabus of Core Courses	COE-40
Departmental Electives	COE-82
Syllabus of Departmental Electives of V Semester	COE-83
Syllabus of Departmental Electives of VI Semester	COE-104
Syllabus of Departmental Electives of VII Semester	COE-123
Syllabus of Departmental Electives of VIII Semester	COE-141
Syllabus of Open Electives	COE-161



Delhi Technological University

(Formerly Delhi College of Engineering)

Shahbad Daultapur, Bawana Road, Delhi – 110 042

VISION

To be a world class university through education, innovation and research for the service of humanity.

MISSION

1. To establish centres of excellence in emerging areas of science, engineering, technology, management and allied areas.
2. To foster an ecosystem for incubation, product development, transfer of technology and entrepreneurship.
3. To create environment of collaboration, experimentation, imagination and creativity.
4. To develop human potential with analytical abilities, ethics and integrity.
5. To provide environment friendly, reasonable and sustainable solutions for local & global needs.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

VISION

The Department of Computer Science & Engineering strives to be a leading world class technology department with excellence in creating, applying, and imparting theoretical, experimental, and applied knowledge through comprehensive educational programs and collaborative research, playing its role as a key node in national and global network to empower the industry and society with the wings of knowledge and power of innovation.

MISSION

1. To nurture the talent of students for research, innovation and excellence in the field of Computer Science & Engineering.
2. To develop highly analytical and qualified computer engineers by giving hands-on training on cutting-edge technology.
3. To produce socially responsible computer engineers with professional ethics.
4. To focus on R&D environment in close partnership with industry and academia globally.
5. To produce up-to date, scientifically tempered, design oriented engineers and scientists capable of lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

- PEO 1:** To acquire in-depth knowledge of software and hardware techniques, which provide a strong foundation to pursue continuing education and nurture the talent for innovation and research.
- PEO 2:** To nurture the talent in leadership qualities, at an appropriate level in order to address the issues in a responsive, ethical and innovative manner.
- PEO 3:** To excel in careers by being a part of success and growth of an organization with whom they will be associated.
- PEO 4:** To inculcate the ability for lifelong learning by active participation in self-study courses, seminars, research projects.

**DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING
BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING)**

I Year: Odd Semester

Teaching Scheme					Contact Hours/Week			Exam Duration (h)		Relative Weights (%)				
S. No.	Subject Code	Course Title	Subject Area	Credit	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
Group A														
1	MA101	Mathematics - I	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP101	Physics – I	ASC	4	3	0	2	3	0	15	15	30	40	-
3	AC101	Chemistry	ASC	4	3	0	2	3	0	15	15	30	40	-
4	ME101	Basic Mechanical Engineering	AEC	4	4	0	0	3	0	25	-	25	50	-
5	ME103	Workshop Practice	AEC	2	0	0	3	0	3	-	50	-	-	50
6	HU101	Communication Skills	HMC	3	3	0	0	3	0	25	-	25	50	-
Total				21	16	1	7							
Group B														
1	MA101	Mathematics - I	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP101	Physics – I	ASC	4	3	0	2	3	0	15	15	30	40	-
3	EE101	Basic Electrical Engineering	AEC	4	3	0	2	3	0	15	15	30	40	-
4	CO101	Programming Fundamentals	AEC	4	3	0	2	3	0	15	15	30	40	-
5	ME105	Engineering Graphics	AEC	2	0	0	3	0	3	-	50	-	-	50
6	EN101	Introduction to Environmental Science	AEC	3	3	0	0	3	0	25	-	25	50	-
Total				21	15	1	9							

I Year: Even Semester

Teaching Scheme					Contact Hours/Week			Exam Duration		Relative Weights (%)				
S. No.	Subject Code	Course Title	Subject Area	Credit	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE	PRE
Group A														
1	MA102	Mathematics – II	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP102	Physics – II	ASC	4	3	0	2	3	0	15	15	30	40	-
3	EE102	Basic Electrical Engineering	AEC	4	3	0	2	3	0	15	15	30	40	-
4	CO102	Programming Fundamentals	AEC	4	3	0	2	3	0	15	15	30	40	-
5	ME102	Engineering Graphics	AEC	2	0	0	3	0	3	-	50	-	-	50
6	EN102	Introduction to Environmental Science	AEC	3	3	0	0	3	0	25	-	25	50	-
Total				21	15	1	9							
Group B														
1	MA102	Mathematics – II	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP102	Physics – II	ASC	4	3	0	2	3	0	15	15	30	40	-
3	AC102	Chemistry	ASC	4	3	0	2	3	0	15	15	30	40	-
4	ME104	Basic Mechanical Engineering	AEC	4	4	0	0	3	0	25	-	25	50	-
5	ME106	Workshop Practice	AEC	2	0	0	3	0	3	-	50	-	-	50
6	HU102	Communication Skills	HMC	3	3	0	0	3	0	25	-	25	50	-
Total				21	16	1	7							

II Year: Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	EC261	Analog Electronics	AEC	4	3	0	2	3	0	15	15	30	40	-
2.	CO201	Data Structures	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	CO203	Object Oriented Programming	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CO205	Discrete Structures	DCC	4	3	1	0	3	0	25	-	25	50	-
5.	CO207	Engineering Analysis and Design (Modelling and Simulation)	DCC	4	3	1	0	3	0	25	-	25	50	-
6.	HU201	Engineering Economics	HMC	3	3	0	0	3	-	25	-	25	50	-
		Total		23										

II Year: Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	EC262	Digital Electronics	AEC	4	3	0	2	3	0	15	15	30	40	-
2.	CO202	Database Management Systems	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	CO204	Operating Systems Design	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CO206	Computer Organization and Architecture	DCC	4	3	1	0	3	0	25	-	25	50	-
5.	CO208	Algorithm Design and Analysis	DCC	4	3	1	0	3	0	25	-	25	50	-
6.	MG202	Fundamentals of Management	HMC	3	3	0	0	3	0	25	-	25	50	-
		Total		23										

III Year: Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	CO301	Software Engineering	DCC	4	3	0	2	3	0	15	15	30	40	-
2.	CO303	Theory of Computation	DCC	4	3	1	0	3	0	25	0	25	50	
3.	CO3xx	Department Elective Course -1	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
4.	CO3xx	Department Elective Course -2	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
5.	UExxx	Open Elective Course	OEC	3	3	0	0	3	0	25	-	25	50	-
6.	HU303	Professional Ethics and Human values	HMC	2	2	0	0	3	0	25	-	25	50	--
		Total		21										

III Year: Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	CO302	Compiler Design	DCC	4	3	0	2	3	0	15	15	30	40	-
2.	CO304	Artificial Intelligence	DCC	4	3	1	0	3	0	25	-	25	50	-
3.	CO306	Computer Networks	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CO3xx	Department Elective Course -3	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
5.	CO3xx	Department Elective Course -4	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
6.	HU302	Technical Communication	HMC	2	2	0	0	3	0	25	-	25	50	-
		Total		22										

IV Year:Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	CO401	B.Tech. Project-I	DCC	4	-	-	-	-	-	-	-	-	-	-
2.	CO403	Training Seminar	DCC	2	-	-	-	-	-	-	-	-	-	-
3.	CO405	Information and Network Security	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CO407	Distributed Systems	DCC	4	3	0	2	3	0	15	15	30	40	-
5.	CO4xx	Department Elective Course -5	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
6.	CO4xx	Department Elective Course -6	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
		Total		22										

IV Year:Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	CO402	B.Tech. Project-II	DCC	8	-	-	-	-	-	-	-	-	-	-
2.	CO404	Data-Warehousing and Data Mining	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	CO4xx	Department Elective Course -7	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
4.	CO4xx	Department Elective Course -8	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/-	30 /25	40/ 50	-
		Total		20										

List of Departmental Elective Courses

S.No	Subject Code	Subject	Elective no.
1.	CO-305	Information Theory and coding	DEC-1, 2
2.	CO-307	Digital Signal Processing	
3.	CO-309	Advanced Data Structures	
4.	CO-311	Microprocessors and Interfacing	
5.	CO-313	Computer Graphics	
6.	CO-315	Optimization Techniques	
7.	CO-317	Soft Computing	
8.	CO-319	Enterprise Java programming	
9.	CO-321	Embedded Systems	
10.	CO-323	Data Compression	
11.	CO-325	Probability and Statistics	
12.	CO-308	Parallel Algorithms	DEC-3, 4
13.	CO-310	Digital Image Processing	
14.	CO-312	Communications Engineering	
15.	CO-314	Optical Networks	
16.	CO-316	High Speed Networks	
17.	CO-318	Advanced Database Management Systems	
18.	CO-320	Multimedia System Design	

19.	CO-322	Real Time System	DEC-5, 6
20.	CO-324	Pattern Recognition	
21.	CO-326	Object Oriented Software Engineering	
22.	CO-409	Robotics	
23.	CO-411	Computer Vision	
24.	CO-413	VLSI Design	
25.	CO-415	Wireless and Mobile Computing	
26.	CO-417	Software Testing	
27.	CO-419	High Performance Computing	
28.	CO-421	Grid and Cluster Computing	
29.	CO-423	Swarm & Evolutionary Computing	
30.	CO-425	Machine Learning	
31.	CO-427	Web Technology	
32.	CO-406	Parallel Computer Architecture	
33.	CO-408	Intellectual Property Rights	
34.	CO-410	Bio Informatics	
35.	CO-412	Software Quality and Metrics	
36.	CO-414	Big Data Analytics	
37.	CO-416	Cloud Computing	
38.	CO-418	Natural Language Processing	
39.	CO-420	Cyber Forensics	
40.	CO-422	Semantic Web and Web Mining	
41.	CO-424	Software Project Management	

List of Open Elective Courses

S.No.	SUBJECT CODE	SUBJECTS
1.	CO351	Enterprise & Java Programming
2.	CO353	E-commerce & ERP
3.	CO355	Cryptography & Information Security
4.	CO357	Operating System
5.	CO359	Intellectual Property Rights & Cyber Laws
6.	CO361	Database Management System
7.	EC351	Mechatronics
8.	EC353	Computer Vision
9.	EC355	Embedded System
10.	EC 357	Digital Image Processing
11.	EC359	VLSI Design
12.	EE351	Power Electronic Systems
13.	EE353	Electrical Machines and Power Systems
14.	EE355	Instrumentation Systems
15.	EE357	Utilization of Electrical Energy
16.	EE359	Non-conventional Energy Systems
17.	EE361	Embedded Systems
18.	EN351	Environmental Pollution & E- Waste Management
19.	EN353	Occupational Health & Safety Management
20.	EN355	GIS & Remote Sensing
21.	EP351	Physics of Engineering Materials
22.	EP353	Nuclear Security
23.	HU351	Econometrics
24.	MA351	History Culture & Excitement of Mathematics
25.	ME351	Power Plant Engineering
26.	ME353	Renewable Sources of Energy
27.	ME355	Combustion Generated Pollution

28.	ME357	Thermal System
29.	ME359	Refrigeration & Air Conditioning
30.	ME361	Industrial Engineering
31.	ME363	Product Design & Simulation
32.	ME365	Computational fluid dynamics
33.	ME367	Finite Element Methods
34.	ME369	Total Life Cycle Management
35.	ME371	Value Engineering
36.	MG351	Fundamentals of Financial Accounting and Analysis
37.	MG353	Fundamentals of Marketing
38.	MG355	Human Resource Management
39.	MG357	Knowledge and Technology Management
40.	PE351	Advance Machining Process
41.	PE 353	Supply Chain Management
42.	PE355	Work Study Design
43.	PE357	Product Design & Simulation
44.	PE359	Total Life Cycle Management
45.	PE361	Total Quality Management
46.	PT361	High Performance Polymers
47.	PT363	Separation Technology
48.	PT365	Non-Conventional Energy
49.	PT367	Polymer Waste Management
50.	PT369	Nanotechnology in Polymers
51.	PT371	Applications of Polymer Blends and Composite
52.	IT 351	Artificial Intelligence and Machine Learning
53.	IT 353	Data Structures and Algorithms
54.	IT 355	Communication and Computing Technology
55.	IT 357	Internet and Web Programming
56.	IT 359	Java Programming
57.	CE351	Geoinformatics and its Applications

SYLLABUS

1. Subject Code: **ME 101/104** : Course Title: **Basic Mechanical Engineering**
2. Contact Hours : L: 04 T: 00 P: 00
3. Examination Duration (Hrs.) : Theory: 3 Practical: 00
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 04
6. Semester : I / II
7. Subject Area : AEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of thermodynamics, fluid mechanics, power plants, engineering materials, manufacturing processes and metrology.
10. Details of Course :

S. No.	Contents	Contact Hours
PART A		
1	Introduction: Introduction to Thermodynamics, Concepts of systems, control volume, state, properties, equilibrium, quasi-static process, reversible & irreversible process, cyclic process. Zeroth Law and Temperature, Ideal Gas. Heat and Work.	05
2	First Law of Thermodynamics for closed & open systems. Non Flow Energy Equation. Steady State, Steady Flow Energy Equation. Second Law of Thermodynamics-Kelvin and Plank's Statements, Clausius inequality, Definition of Heat Engines, Heat pumps, Refrigerators. Concept of Energy and availability. Carnot Cycle; Carnot efficiency, Otto, Diesel, Dual cycle and their efficiencies.	12
3	Principles of power production, basic introduction about thermal power plant, hydroelectric power plant and nuclear power plant.	04

4	Properties & Classification of Fluids, Ideal & real fluids, Newton's law of viscosity, Pressure at a point, Pascal's law, Pressure variation in a static fluid, General description of fluid motion, stream lines, continuity equation, Bernoulli's equation, Steady and unsteady flow.	07
PART B		
5	Introduction to engineering materials for mechanical construction. Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminum and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.	12
6	Introduction to Manufacturing processes for various machine elements. Introduction to Casting & Welding processes. Sheet metal and its operations. Introduction to machining processes – turning, milling, shaping, drilling and boring operations. Fabrication of large and small assemblies – examples nuts and bolts, turbine rotors etc.	12
7	Introduction to quality measurement for manufacturing processes; standards of measurements, line standards, end standards, precision measuring instruments and gauges: vernier calliper, height gauges, micrometer, comparators, dial indicator, and limit gauges.	04
Total		56

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
TEXT BOOKS:		
1	Engineering Thermodynamics, P. K. Nag, Tata McGrawa-Hill	2005
2	Fundamentals of Classical Thermodynamics, G. J. Van Wylen and R. E. Santag.	1994
3	Manufacturing Processes, Kalpakjian	2013
4.	Basic Mechanical Engineering,1/e, Pravin Kumar, Pearson Education, Delhi	2013

REFERENCE BOOKS:		
1	Introduction to Fluid Mechanics and Fluid Machines, S. K. Som and G. Biswas	2013
2	Fluid Mechanics and Hydraulic Machines, R. K. Bansal	2010
3	Workshop Practices, K. Hazara Chowdhary	2007
4	Workshop Technology, W. A. J. Chapman	1972
5	Production Engineering, R. K. Jain, Khanna Publishers	2001

1. Subject Code: **AC 101/102** : Course Title: **Chemistry**
2. Contact Hours : L: 03 T: 00 P: 02
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 00
5. Credits : 04
6. Semester : I / II
7. Subject Area : ASC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of Engineering Chemistry, Material characterization and green Chemistry.
10. Details of Course :

S. No.	Contents	Contact Hours
1.	Conventional Analysis: Volumetric Analysis, Types of Titrations, Theory of Indicators.	06
2.	Spectral Methods of Analysis: UV-visible, IR, NMR & MS: Principles and Applications.	08

3.	Thermal Methods of Analysis: Thermo-gravimetry, Differential thermal analysis and Differential Scanning Calorimetry: Principles and Applications.	04
4.	Polymers & Plastics: Functionality and Degree of Polymerization, Mechanism of Polymerization, Molecular Weights of Polymers, Methods of polymerization, Functional Polymers, Industrial applications of Polymers.	06
5.	Electrochemistry: Electrochemical cells, components, characteristics of batteries. Primary and Secondary battery systems, Zinc-Carbon cells, Lead storage and lithium batteries. Fuel Cells, Electro-deposition, Electrical and chemical requirements. Electroplating bath and linings. Agitation, Circulation and filtration equipment.	08
6.	Phase Equilibrium: Definitions of Phase, component and degree of freedom, Gibb's phase rule. One component systems: Water and sulphur. Two component systems: Pb-Ag and Cu-Ni.	06
7.	Green Chemistry: Principles of Green Chemistry, Examples of Green Methods of Synthesis, Reagents and Reactions, Evaluation of feedstocks, Future trends in Green Chemistry.	04
Total		42

11. Suggested Books:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1	Introduction to Thermal Analysis/ Michael E. Brown/ Springer Netherlands	2001
2	Vogel's Quantitative Chemical Analysis/ J. Mendham, R.C. Denney, J. D. Barnes, M.J.K. Thomas / Prentice Hall/6 edition	2000
3	Green Chemistry: Theory & Practice/P.T. Anastas & J.C. Warner/ Oxford Univ Press	2000
4	Polymer Science and Technology/ Fried Joel R./ PHI; 2 edition	2005
5	Electrochemistry/ Philip H. Rieger / Springer	2009

1. Subject Code: **AP 101** : Course Title: **Physics – I**
2. Contact Hours : L: 03 T: 00 P: 02
3. Examination Duration (Hrs.) : Theory:03 Practical: 00
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 00
5. Credits : 04
6. Semester : I
7. Subject Area : ASC
8. Pre-requisite : NIL
9. Objective : To impart knowledge of basic concepts in applied physics and make the students familiar with topics like interference, diffraction, polarization, fiber optics, lasers, wave mechanics, etc. This course is also aimed at enhancing the analytical capability of the engineering students.
10. Details of Course :

S. No.	Contents	Contact Hours
1.	RELATIVITY: Review of concepts of frames of reference and Galilean transformation equation, Michelson – Morley experiment and its implications, Einstein’s special theory of relativity, Lorentz transformation equations, Law of addition of velocities, Mass variation with velocity, Concept of energy and momentum, Mass energy relation.	08
2.	OSCILLATIONS & WAVES: Damped and forced oscillations, Resonance (amplitude and power), Q – factor, Sharpness of resonance. Equations of longitudinal and transverse waves and their solutions, Impedance, Reflection and transmission of waves at a boundary, Impedance matching between two medium.	07

3.	PHYSICAL OPTICS: Interference by division of wave front and amplitude, Multiple beam interference and Fabry-Perot interferometer, Fresnel diffraction through a straight edge, Zone plate, Fraunhofer diffraction, single slit and N-slit / grating, Resolving power of telescope, prism and grating. Polarization by reflection and by transmission, Brewster's law, Double refraction, elliptically and circularly polarized light, Nicol prism, Quarter and half wave plates.	12
4.	OPTICAL INSTRUMENTS: Cardinal points of co-axial lens systems, spherical and chromatic aberrations and their removal, Huygens and Ramsden's eyepiece.	05
5.	Lasers: Coherence and coherent properties of laser beams, Brief working principle of lasers, Spontaneous and stimulated Emission, Einstein's co-efficient, Ruby laser, He-Ne laser.	06
6.	Optical Fiber: Classification of optical fibers, Refractive index profile, Core-cladding refractive index difference, Numerical aperture of optical fiber, Pulse dispersion in optical fiber (ray theory).	04
Total		42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication/ Reprint
1.	Physics of Vibrations and Waves, by H.J. Pain.	2005/ John Wiley & Sons Ltd
2.	Vibrations and Waves, by A.P. French.	1971/CRC Press
3.	Perspective of Modern Physics, by Arthur Beiser	1981/ McGraw-Hill
4.	Optics, by A. Ghatak.	2006/Tata McGraw-Hill
5.	Berkley Physics Course Vol – 1.	2009/ Tata McGraw-Hill

1. Subject Code: **AP 102** : Course Title: **Applied Physics-II**
2. Contact Hours : L: 03 T: 00 P: 02
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 00
5. Credits : 04

6. Semester : II
7. Subject Area : ASC
8. Pre-requisite : NIL
9. Objective : This course gives a balance account of the fundamentals of Physics as well as some of recent developments in this area best suited to the Engineering applications in different branches and to provide the knowledge and methodology necessary for solving problems in the field of engineering.
10. Details of Course :

S.No.	Contents	Contact Hours
1.	Quantum Physics : Failure of classical physics ,Compton effect , Pair production, de-broglie relation, wave function, Probability density, Schrodinger wave equation, operators, expectation values and eigen-value equation, particle in a box, simple harmonic oscillator problem, concept of degeneracy.	10
2.	Classical Statistics: Microscopic-macroscopic systems, concept of phase space, basic postulates of statistical mechanics, Maxwell—Boltzmann distribution law.	05
3.	Quantum Statistics: Fermi—Dirac and Bose—Einstein Distribution, Fermi- Dirac probability function, Fermi energy level.	05
4.	Nuclear Physics: Nuclear properties, constituent of the nucleus, binding energy, stable nuclei, radioactive decay law (alpha and beta spectrum), Q-value of nuclear reaction , nuclear models: liquid drop and shell model, nuclear fission and fusion, elementary ideas of nuclear reactors.	06
5.	Electrodynamics: Maxwell's equations, concept of displacement current, Derivation of wave equation for plane electromagnetic wave, Poynting vector. Poynting theorem, Energy density, wave equation in dielectric & conducting media.	09

6	Semiconductor Physics: Concept of intrinsic and extrinsic semiconductors, Fermi level, characteristics of PN Junction, static and dynamic resistance, zener diode and LED, diode as a rectifier, transistor (PNP and NPN) characteristics, current and voltage gain.	07
Total		42

11. Suggested Books:

S.No.	Name of Books/Authors	Year of Publication/ Reprint
1.	Nuclear Physics, by Erwin Kaplan	2002/Narosa
2.	Concept of Nuclear Physics, by Bernard Cohen	2001/ McGraw-Hill
3.	Perspective of Modern Physics, by Arthur Beiser	1969/ McGraw-Hill US
4.	Electrodynamics, by Griffith	2012/PHI Learning
5.	Electricity & magnetism, by Rangawala& Mahajan.	2012/ McGraw-Hill

1. Subject Code: **EE-101/102** : Course Title: **Basic Electrical Engineering**
2. Contact Hours : L: 03 T: 00 P: 02
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 00
5. Credits : 04
6. Semester : I / II
7. Subject Area : AEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of electrical circuits, magnetic circuits, transformer and measuring instruments.

10. Details of Course

:

S. No.	Contents	Contact Hours
1	Introduction: Role and importance of circuits in Engineering, concept of fields, charge, current, voltage, energy and their interrelationships. V- I characteristics of ideal voltage and ideal current sources, various types of controlled sources, passive circuit components, V-I characteristics and ratings of different types of R, L, C elements. DC Network: Series and parallel circuits, power and energy, Kirchhoff's Laws, delta-star transformation, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Tellegen's theorem.	10
2	Single Phase AC Circuits: Single phase emf generation, average and effective values of sinusoids, complex representation of impedance, series and parallel circuits, concept of phasor, phasor diagram, power factor, complex power, real power, reactive power and apparent power, resonance in series and parallel circuits, Q-factor, bandwidth and their relationship, half power points.	10
3	Three-Phase AC Circuits: Three phase emf generation, delta and star connection, line and phase quantities, solution of three phase circuits: balanced supply and balanced load, phasor diagram, three phase power measurement by two wattmeter method.	05
4	Magnetic Circuits and Transformers: Amperes circuital law, B-H curve, concept of reluctance, flux and mmf, analogies between electrical and magnetic quantities, solution of magnetic circuits, hysteresis and eddy current losses, mutual inductance and dot convention, single phase transformer – construction and principle of working, auto transformer and their applications.	12
5	Measuring Instruments: Analog indicating instruments, PMMC ammeters and voltmeters, damping in indicating instruments, shunt and multipliers, moving iron ammeter and voltmeters, dynamometer type instruments, multimeters, AC watt-hour meters. digital voltmeters, ammeters and watt meters.	05
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
1	Basic Electrical Engineering, A.E. Fitzgerald , David Higginbotham , Arvin Gabel, Tata McGraw-Hill Publishing Company; 5 th Edition.	2009
2	Electrical and Electronic Technology, Edward Hughes, Ian Mckenzie Smith, John Hiley, Pearson Education, 10 th edition.	2010
3	Linear Circuit Analysis: Time, Domain, Phasor and Laplace Transform Approaches Raymond A. De Carlo, Pen-Min Lin, Oxford University Press, 2 nd Edition.	2001
4	Hayt, Kemmerly & Durbin, "Engineering Circuit Analysis", Tata McGraw Hill Publishing Company Ltd.	2007
5	Electrical Engineering Fundamental V. Del Toro, Prentice-Hall, 2 nd Edition.	1989
6	Basic Electrical Engineering, C.L. Wadhwa, New Age International Pvt Ltd Publishers	2007
7	Introduction to Electrical Engineering, Mulukutla S. Sarma, Oxford University Press Inc.	2001

1. Subject Code: **ME-102/105** : Course Title: **Engineering Graphics**
2. Contact Hours : L: 00 T: 00 P: 03
3. Examination Duration (Hrs.) : Theory: 0 Practical: 03
4. Relative Weight : CWS: 00 PRS: 50 MTE: 00 ETE: 00 PRE: 50
5. Credits : 02
6. Semester : I / II
7. Subject Area : AEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with drafting and engineering drawing practices.

10. Details of Course

:

S. No.	Contents	Contact Hours
PART A		
1	General: Importance, Significance and scope of engineering drawing Lettering, Dimensioning, Scales, Sense of Proportioning, Different types of Projections, B.I.S. Specification, line symbols, rules of printing.	03
2	Projections of Points and Lines: Introduction of planes of projection, Reference and auxiliary planes, projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance, intersecting and non-intersecting lines.	03
3	Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points lines in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.	03
4	Projections of Plane Figures: Different cases of plane figure (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.	03
5	Projection of Solids: Simple cases when solid is placed in different positions, Axis, faces and lines lying in the faces of the solid making given angles.	03
6	Isometric and Orthographic Views: First and Third angle of system of projection, sketching of Orthographic views from pictorial views and vice –versa, Sectional views.	09
7	Principles of dimensioning.	03
8	Development of lateral surfaces of simple solids.	06
9	Introduction to available drafting softwares like AutoCAD	09
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers	Year of Publication/ Reprint
TEXT BOOKS:		
1	Engineering Graphics, Narayana, K.L. and Kannaiah, P, Tata McGraw Hill	2005
REFERENCE BOOKS:		
1	Engineering Graphics, Naveen Kumar and S C Sharma	2013
2	Engineering Graphics, Chandra, A.M. and Chandra Satish, CRC Press	2003

1. Subject Code: **EN-101/102** : Course Title: **Environmental Science**
2. Contact Hours : L: 03 T: 00 P: 00
3. Examination Duration (Hrs.) : Theory: 03 Practical: 0
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 03
6. Semester : I / II
7. Subject Area : AEC
8. Pre-requisite : NIL
9. Objective : To introduce basic fundamentals of Environmental Science.

10. Details of Course :

S. No.	Contents	Contact Hours
1.	<p>Introduction to Environment Definition, Scope, and importance of environmental studies; need for public awareness; Segments of environment- lithosphere, hydrosphere, atmosphere, and biosphere; Environmental degradation; Role of individual in environmental conservation; sustainable lifestyle.</p>	06
2.	<p>Natural Resources Forest Resources : Deforestation, mining, dams and their effects on forest and tribal people; Water resources: over-utilization, floods, drought, conflicts over water, dams-benefits and problems; Mineral resources: Use and exploitation, environmental effects; Food resources : World food problems, changes caused by modern agriculture, fertilizer-pesticide problems, water logging, salinity; Energy resources : Growing energy needs, renewable and non renewable energy sources; Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.</p>	09
3.	<p>Ecosystems and Biodiversity Concept of an ecosystem, Structure and function, Energy flow, Ecological succession, ecological pyramids; Types, characteristic features, structure and function of the Forest, Grassland, Desert, and Aquatic ecosystems Concept of Biodiversity, definition and types, Bio-geographical classification of India; Value of biodiversity; Biodiversity at global, national and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity.</p>	09
4.	<p>Environmental Pollution Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.</p>	09

5.	Social Issues and Environment Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation, Consumerism and waste products, Environment Laws and Acts, Issues involved in enforcement of environmental legislation, Public awareness. Population growth, variation among nations, Family Welfare Programme.	09
Total		42

1. Subject Code: **MA-101** : Course Title: **Mathematics – I**
2. Contact Hours : L: 03 T: 01 P: 00
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 04
6. Semester : I
7. Subject Area : ASC
8. Pre-requisite : NIL
9. Objective : To acquaint the students with the knowledge of series & sequence, single & multiple variable calculus, knowledge of vector calculus and their applications.

10. Details of Course

:

S. No.	Contents	Contact Hours
1.	Infinite series: Tests for convergence of series (Comparison, Ratio, Root, Integral, Raabe's, logarithmic), Alternating series, Absolute convergence, Conditional convergence.	06
2.	Differential & Integral Calculus of single variable: Taylor's & MaClaurin's expansion, Radius of curvature, Tracing of some standard curves, Applications of definite integral to Area, Arc length, Surface area and volume (in cartesian, parametric and polar co-ordinates).	07
3.	Calculus of several variables: Partial differentiation, Euler's theorem, Total differential, Taylor's theorem, Maxima-Minima, Lagrange's method of multipliers, Application in estimation of error and approximation.	07
4.	Multiple Integrals: Double integral (Cartesian and polar co-ordinates), Change of order of integration, Triple integrals (Cartesian, cylindrical and spherical co-ordinates), Beta and Gamma functions, Applications of multiple integration in area and volume.	08
5.	Vector Differential Calculus: Continuity and differentiability of vector functions, Scalar and Vector point function, Gradient, Directional Derivative, Divergence, Curl and their applications.	07
6.	Vector Integral Calculus: Line integral, Surface integral and Volume integral, Applications to work done by the force, Applications of Green's, Stoke's and Gauss divergence theorems.	07
Total		42

11. Suggested Books:

S. No.	Name of Books/Authors Publishers	Year of Publication/ Reprint
1.	Advanced engineering mathematics: Kreyszig; Wiley-India. 9 th Edition ISBN : 978-81-265-3135-6	2011
2.	Advanced engineering mathematics: Jain/Iyenger; Narosa. 2 nd Edition. ISBN: 81-7319-541-2	2003

3.	Advanced engineering mathematics: Taneja; I K international ISBN: 978-93-82332-64-0	2014
4.	Advanced engineering mathematics: Alan Jeffery; Academic Press ISBN: 978-93-80501-50-5	2010
5.	Calculus and analytic geometry: Thomas/Finney; Narosa. ISBN : 978-81-85015-52-1	2013

1. Subject Code: **MA-102** : Course Title: **Mathematics – II**
2. Contact Hours : L: 03 T: 01 P: 00
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 04
6. Semester : II
7. Subject Area : ASC
8. Pre-requisite : NIL
9. Objective : To impart knowledge of matrices and applications closed form and series solutions of Differential equations, Laplace Transform, Fourier series, Fourier Transform & their applications.
10. Details of Course :

S. No.	Contents	Contact Hours
1.	Matrices: Rank of a matrix, Inverse of a matrix using elementary transformations, Consistency of linear system of equations, Eigen-values and Eigenvectors of a matrix, Cayley Hamilton theorem, Diagonalization of matrix.	07

2.	Ordinary differential equations: Second & higher order linear differential equations with constant coefficients, General solution of homogenous and non - homogenous equations, Method of variation of parameters, Euler-Cauchy equation, Simultaneous linear equations, Applications to simple harmonic motion.	08
3.	Special Functions: Power series method, Frobenius method, Legendre equation, Legendre polynomials, Bessel equation, Bessel functions of first kind, Orthogonal property.	08
4.	Laplace Transforms: Basic properties, Laplace transform of derivatives and integrals, Inverse Laplace transform, Differentiation and Integration of Laplace transform, Convolution theorem, Unit step function, Periodic function, Applications of Laplace transform to initial and boundary value problems.	08
5.	Fourier series : Fourier series, Fourier Series of functions of arbitrary period, Even and odd functions, half range series, Complex form of Fourier Series, Numerical Harmonic analysis.	06
6.	Fourier Transforms: Fourier Transforms, Transforms of derivatives and integrals, Applications to boundary value problem in ordinary differential equations (simple cases only).	05
Total		42

11. Suggested Books:

S. No.	Name of Books/Authors Publishers	Year of Publication/ Reprint
1.	Advanced engineering mathematics: Kreyszig; Wiley. ISBN : 978-81-265-3135-6	2011
2.	Advanced engineering mathematics: Jain/Iyenger; Narosa. ISBN: 81-7319-541-2	2003
3.	Advanced engineering mathematics: Taneja; I K international ISBN: 978-93-82332-64-0	2014
4.	Advanced engineering mathematics: Alan Jeffery; Academic Press ISBN: 978-93-80501-50-5	2010

5.	Advanced engineering mathematics: Peter V. O'Neil Cengage Learning. ISBN : 978-81-315-0310-2	2007
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1. Subject Code: **HU 101/102** : Course Title: **Communication Skills**
2. Contact Hours : L: 03 T: 00 P: 00
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 03
6. Semester : I / II
7. Subject Area : HMC
8. Pre-requisite : NIL
9. Objective : To impart essential skills required for effective communication in English language.
10. Details of Course :

Sl. No.	Contents	Contact Hours
1	Communication Communication: Process, Features, Barriers Language, Technology and Communication	02
2	Unit II: Grammar and Usage Vocabulary-Words/Word Formation, Confusing Word Pairs Sentence Construction, Sentence Types, Direct/Indirect Speech Punctuation, Error Spotting, Idioms and Phrases	06
3	Unit III: Oral Communication Phonetics of English, Vowels, Consonants, syllables, transcription of words and simple sentences using IPA: Speech Sounds and their articulation; phonemes, Syllable, Stress, Transcription of words and Simple Sentences Language Lab Practice for Oral Communication: Project Presentations, Group Discussions, Debates, Interviews etc.	12

4	Unit IV: Written Technical Communication Composition- Descriptive, Explanatory, Analytical and Argumentative Writing Paragraphs (Essay, Summary, Abstract) Reading and Comprehension, Providing working mechanism of instruments, appliances, description of processes, their operations and descriptions; Drawing Inferences from graphs, charts, Diagrams etc.	12
5	Unit V: Texts for Appreciation and Analysis Improve your Writing by V. N. Arora and Lakshmi Chandra (OUP) Vijay Seshadri. <i>3 Sections</i> (2014) or <i>Gestures: Poetry from SAARC Countries</i> Ed. K. Satchidanandan. Sahitya Akademi: New Delhi ISBN- 81-260-0019-8 Ursula K. Leguin. <i>The Telling</i> , Harcourt Inc. 2000 or <i>Animal Farm</i> by George Orwell (1945) ISBN: 9781502492791 or <i>Frankenstein</i> by Mary Shelley (1818) Harper Collins India Ltd.: NOIDA ISBN: 9780007350964	10
Total		42

Text Books:

Sl.No.	Name of Books, Authors, Publishers	Year of Publication/ Reprint
1.	<i>Improve your Writing</i> by V.N.Arora and Lakshmi Chandra OUP: Delhi ISBN 13: 978-0-19-809608-5	1981, 2013 (Revised Edition)
2.	<i>Technical Communication: Principles and Practice</i> by Meenakshi Raman and Sangeeta Sharma OUP: Delhi. ISBN-13: 9780-19-806529-6	2011, Reprinted in 2014
3.	<i>English Phonetics and Phonology: A Practical Course.</i> By Peter Roach. Cambridge: Cambridge University Press. (Fourth Edition) ISBN: 978-0-521-14921-1	2009, 2014 (Reprinted)
4.	Vijay Seshadri. <i>3 Sections</i> , Harper Collins India Ltd.: India. ISBN: 9789351367734. or <i>Gestures: Poetry from SAARC Countries</i> Ed. K. Satchidanandan. Sahitya Akademi: New Delhi ISBN- 81-260-0019-8	2014 1996, Reprint 2007

5.	Ursula K. Leguin. <i>The Telling</i> , Harcourt Inc. 2000 or <i>Animal Farm</i> by George Orwell (1945) ISBN: 9781502492791 or <i>Frankenstein</i> by Mary Shelley (1818) Harper Collins India Ltd.: Noida ISBN: 9780007350964	2000 1945/ 2014 Reprint 1818/ Latest Reprint 2012
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11. Suggested Books

Sl.No.	Name of Books, Authors, Publishers	Year of Publication / Reprint
1.	Maison, Margaret M. <i>Examine Your English</i> . Orient Blackswan: Delhi,	2009
2.	Sharma, Sangeeta & Binod Sharma. <i>Communication Skills for Engineers & Scientists</i> , PHI.	2012
3.	Swan, Michael, Catherine Walter. <i>Oxford English Grammar Course</i> . OUP: Delhi,	2011
4.	Kumar, E Suresh & P Sreehari <i>A Handbook for English Language Laboratories</i> , 2 nd Edition, Cambridge University Press, Foundation Books,	2014
5.	Dutt, P Kiranmai, Geetha Rajeevan & CLN Prakash <i>A Course in Communication Skills</i> . Cambridge University Press (Foundation Books).	2013
6.	Mitra, Barun K. <i>Personality Development and Soft Skills</i> .OUP: Delhi.	2011
7.	Apps for Phonetics- Advanced English Dictionary for Windows phone & OALD for Android phone	Latest

1. Subject Code: **CO 101/102** : Course Title: **Programming Fundamentals**
2. Contact Hours : L: 03 T: 00 P: 02
3. Examination Duration (Hrs.) : Theory : 3 Practical : 00
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 00
5. Credits : 04

6. Semester : I / II
7. Subject Area : AEC
8. Pre-requisite : NIL
9. Objective : To introduce fundamentals of Programming using C and C++, concepts of program development and object Oriented Programming.
10. Details of Course :

S.No.	Contents	Contact Hours
1.	Introduction: Concepts of algorithm, flow chart, Introduction to different Programming Languages like C, C++, Java etc. Elementary Programming in C: Data types, assignment statements, Arithmetic, unary, logical, bit-wise, assignment and conditional operators, conditional statements and input/output statements.	06
2.	Iterative programs using loops- While, do-while, for statements, nested loops, if else, switch, break, Continue, and goto statements, comma operators. Concept of subprograms.	06
3.	Array representation, Operations on array elements, using arrays, multidimensional arrays. Structures & Unions: Declaration and usage of structures and Unions. Defining and operations on strings.	06
4.	Pointers: Pointer and address arithmetic, pointer operations and declarations, using pointers as function argument. File: Declaration of files, different types of files. File input/ output and usage-, File operation: creation, copy, delete, update, text file, binary file..	08
5.	Concept of macros and pre-processor commands in C, Storage types: Automatic, external, register and static variables. Sorting and searching algorithms: selection sort, bubble sort, insertion sort, merge sort, quick sort and binary search.	08
6.	Introduction to Object Oriented Programming: OOPS concepts: class, encapsulation, inheritance, polymorphism, overloading etc. C++ introduction, Concept of class, methods, constructors, destructors, inheritance.	08
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
1.	The C Programming Language, 2nd Edition, Brian W. Kernighan, Dennis M. Ritchie, PHI, (ISBN-978-8120305960)	1988
2.	Let Us C, 13 th Edition, YashavantKanetkar, BPB Publications, (ISBN: 978-8183331630)	2013
3.	Mastering C, Venugopal K R, Sudeep R Prasad, Edition 1, McGraw Hill Education. (ISBN- 9780070616677)	2006
4.	Programming in ANSI C , Sixth Edition, McGraw Hill Education (India) Private Limited E Balagurusamy (ISBN: 978-1259004612)	2012
5.	Object Oriented Programming with C++, Sixth edition , E. Balagurusamy, McGraw Hill Education (India) Private Limited (ISBN: 978-1259029936)	2013

1. Subject Code: **ME 103/106** : Course Title: **Workshop Practice**
2. Contact Hours : L: 00 T: 00 P: 03
3. Examination Duration (Hrs.) : Theory : 00 Practical : 03
4. Relative Weight : CWS: 00 PRS: 50 MTE: 00 ETE: 00 PRE: 50
5. Credits : 02
6. Semester : I / II
7. Subject Area : AEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with manufacturing shops like Carpentry, Foundry, Welding, Machining, Fitting and Smithy.

10. Details of Course

:

Sl. No.	Shop	Description	Contact Hours
1.	Carpentry	Study of Different Carpentry Tools and Pattern Making of a given job (pulley/screw jack body)	03
2.	Foundry	Study of Different Foundry Tools and Furnaces Making a green sand mould of a given pattern (pulley/ screw jack body) and its casting	06
3.	Welding	Arc welding of butt joint, T-joint and lap joint Study of other welding/ joining Techniques	09
4.	Machining	Study of lathe, milling, drilling machine, shaper, planer and grinding machine. Demonstration of a job on lathe	09
5.	Fitting	Study of various fitting hand tools, marking and measuring devices Preparation of a given job (box / funnel)	09
6.	Smithy	Study of different forming tools and power press Preparation of a given job (bolt / chisel)	06
Total			42

8. Pre-requisite : Fundamentals of Programming
9. Objective : To study different kinds of data structures with their respective applications.
10. Details of Course

S.No.	Contents	Contact Hours
1.	<p>Introduction: Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to abstract data types, design, implementation and applications. Introduction to List data structure.</p> <p>Arrays and Strings: Representation of Arrays in Memory: one dimensional, Two dimensional and Multidimensional, Accessing of elements of array, performing operations like Insertion, Deletion and Searching. Sorting elements of arrays. Strings and String Operations.</p> <p>Stacks and Queues: Introduction to data structures like Stacks and Queues. Operations on Stacks and Queues, Array representation of Stacks , Applications of Stacks : recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues.</p>	8
2.	<p>Linked Lists: Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List. Concepts of Circular linked list and Doubly linked list and their Applications. Stacks and Queues as linked list.</p>	6
3.	<p>Trees: Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching , Insertion and Deletion , Applications of Binary search Trees , Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees.</p>	8
4.	<p>Searching and Sorting: Linear Search, Binary search, Interpolation Search, Insertion Sort, Quick sort, Merge sort, Heap sort, sorting on different keys, External sorting.</p>	7

9. Objective : To provide knowledge of Object Oriented programming features.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Object oriented paradigm & C++ at a glance: Evolution of programming paradigm, structured versus object-oriented development, elements of object-oriented programming, Objects, classes, methods, popular OOP languages, software reuse. Classes and objects: Introduction, Class revisited, constant objects and constructor, static data members with constructors and destructors, constructor overloading, nested classes, objects as arguments, returning objects , friend functions and friend classes, constant parameters and member functions, static data and member functions.	8
2.	Dynamic objects: Introduction, pointers to objects, array of objects, pointers to object members, this pointer, self-referential classes Operator overloading and Inheritance: overloading of new and delete operators, conversion between objects and basic types, conversion between objects of different classes, overloading with friend functions, abstract classes, inheritance types , virtual base classes, virtual functions, pointer to derived class objects, and base class objects, pure virtual functions, virtual destructors. Generic programming with templates: Introduction, function templates, overloaded function templates, class templates, inheritance of class template, class template containership, class template with overloaded operators.	7
3.	Introduction to byte code, security and portability, Data Types, variables, operators, arrays, type conversion and casting, type promotion, Control statements, standard input-output, Designing Classes, constructors, methods, access specifiers : public, private, protected, inheritance, packages and interfaces, Math, String, Vectors, and Array List classes, polymorphism: function and operator overloading, function overriding, abstract classes.	6
4.	Exception Handling: exception types, nested try-catch, throw, throws and finally statements, Multithread Programming: thread creation, synchronization and priorities.	6

5. Credits : 4
6. Semester : III
7. Subject Area : DCC
8. Pre-requisite : Nil
9. Objective : To provide knowledge of combinatorial problems, algebraic structures and graph theory required for building mathematical foundation of computer science.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Formal Logic: Statement, Symbolic Representation and Tautologies, Quantifiers, Predicator and validity, Normal form, Prepositional Logic, Predicate Logic, Logic Programming and Proof of correctors	3
2.	Proof, Relation and Analysis of Algorithm: Technique for theorem proving : Direct Proof, Proof by Contra position, proof by exhausting cases and proof by contradiction, Principle of mathematical induction, principle of complete induction, recursive definition, solution methods for linear, first-order recurrence relations with constant coefficients, analysis of algorithms involving recurrence rotations-recursive selection sort, binary search, quick sort, solution method for a divide-and-conquer recurrence relation.	7
3.	Sets and Combinations: Sets, Subsets, powersets, binary and unary operations on a set, set operations/set identities, fundamental counting principles, principle of inclusion, exclusion and pigeonhole, permutation and combination, Pascal's triangles, binomial theorem, representation of discrete structures.	8
4.	Relation/function and matrices: Rotations, properties of binary rotations, operation on binary rotation, closures, partial ordering, equivalence relation, properties of function, composition of function, inverse, binary and n-ary operations, characteristics of permutation function, composition of cycles, Boolean matrices, Boolean matrices multiplication.	7

5.	Lattices & Boolean Algebra: Lattices: definition, sublattices, direct product, homomorphism Boolean algebra: Definition, properties, isomorphic structures (in particular, structures with binary operations) subs algebra, direct product and homomorphism, Boolean function, Boolean expression, representation & minimization of Boolean function.	7
6.	Graph Theory Terminology, isomorphic graphs, Euler's formula (Proof) four color problem and the chromatic number of a graph, five color theorem. Trees terminology, directed graphs, Computer representation of graphs, Warshall's algorithms, Decision Trees, Euler path & Hamiltonian circuits, Shortest path & minimal spanning trees, Depth-first and breadth first searches, analysis of search algorithm, trees associated with DFS & BFS Connected components, in order, preorder & post order tree traversal algorithms.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers / Year of Publication/ Reprint
Text Books	
1.	Kenneth H. Rosen, "Discrete Mathematics and Its Applications", TMH ISBN: 9780070681880),1999
2.	C.L. Liu, "Elements of Discrete Mathematics", TMH (ISBN: 9780007043477),2000
3.	Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI (ISBN- 978-0132297516),1996
Reference Books	
1.	NarsinghDeo, "Graph Theory With Application to Engineering and Computer Science", PHI (ISBN: 9788120301450), 2004
2.	J. P. Trembly& P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill (ISBN: 0070651426),1997

10. Details of Course:

S.No.	Contents	Contact Hours
1.	Introduction: Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand-Price elasticity of Demand, Cross elasticity of Demand, Production - Production Function, Production Process and Factors of Production, Market – Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts- Opportunity Cost, Total Cost, Average Cost; Marginal Cost; Life Cycle cost, Sunk Cost; Preparation of Cost Sheet Profit Maximisation- numerical problem.	10
2.	Money- its evaluation and function, Bank- Commercial Bank and Central Bank and brief idea about function of banking system:. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, Balance of Payment.	10
3.	Role of Science, Engineering and Technology in Economic Development: Seven salient Feature of the Indian Economy; Inclusive Growth; relevance for the Indian Economy; Globalisation& opening up of the Indian Economy; GDP- definition and Its measurement; How knowledge of engineering and ology may be used to improve life at slum; Green Revolution and White revolution. Reasons for their success and can we replicate them. Appropriate Technology & Sustainable Development. Entrepreneurship: Macro environment for promotion of entrepreneurship: How environment has changed after advent of IT and Globalisation.	12
4.	Elementary Economic Analysis: Interest formulas and their Applications; Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future worth method, Annual equivalent, Internal Rate of Return; Business Risk; Factors which should be taken care while deciding price of the product in the market.	10
TOTAL		42

2.	Introduction Logic Gates, Logic Families TTL, Tristate Logic, ECL, CMOS and T ² L Logic, Logic parameters, Bistable, Monostable, Astable and Schmitt trigger circuit.	8
3.	Gated memories, M/S flip flips, Shift Registers Serial & Parallel Counters, Ring counters, Up Down counters. Designing of combinational circuits like code converter, address decoders, comparators, etc.	8
4.	Introduction to semiconductor memories: ROM, PROM, EPROM, STATIC & DYNAMIC RAM. Introduction to Encoders, Decoders, Multiplexer, Demultiplexer, Designing Combinational circuits with multiplexers and other digital logic blocks, PROM. Concept of Digital to Analog Conversion Ladder Networks, and Concept of Analog to Digital conversion: Dual Slope method.	6
5.	V-F conversion, stair case Ramp-method/counter method successive approximation type of A/D converters etc.	6
6.	Introduction to design of synchronous & asynchronous sequential circuit flow table realization from verbal description, ASM charts, minimization of flow table and concept of state assignment.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Thomas L. Floyd, Digital Fundamentals, 10 th Edition, Pearson Education, ISBN-13: 9780132359238, 2009
2.	M. Morris Mano, Digital Design, 4 th Edition, Pearson Education ISBN-13: 9780131989245, 2007
Reference Books	
1.	Donald P. Leach and Albert Paul Malvino, Goutam Saha, Digital Principles and Applications, 6 th Edition, TMH, ISBN: 0070601755, 2006
2.	John F. Wakerly, Digital Design: principles and practices, 4th Edition, Pearson Education, ISBN-10: 0131863894, 2006
3.	John. M Yarbrough, Digital Logic Applications and Design, Thomson Learning, ISBN-10: 0314066756, 2002

6. Semester : IV
7. Subject Area : DCC
8. Pre-requisite : Data Structures
9. Objective : To familiar with the fundamental principles of the operating system, its services and functionalities, the concepts of processes, synchronization and scheduling, memory management and need for protection in computer systems

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. Operating System Structure: System Components, System structure, Operating System Services.	4
2.	Concurrent Processes: Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling. CPU Scheduling: Scheduling Concept, Performance Criteria of Scheduling Algorithm, Evolution, Multiprocessor Scheduling.	9
3.	Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.	8
4.	Memory Management: Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replacement algorithms, Allocation of frames, Thrashing, Cache memory organization, Impact on performance.	9

10. Details of Course

S.No.	Contents	Contact Hours
1.	<p>Introduction: Digital computer generation, computer types and classifications, functional units and their interconnections, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. REGISTER TRANSFER LANGUAGE: Data movement around registers. Data movement from/to memory, arithmetic and logic micro operations. Concept of bus and timing in register transfer.</p>	8
2.	<p>Control Unit: Instruction types, formats, instruction cycles and sub-cycles (fetch and execute etc.), micro-operations, execution of a complete instruction.</p> <p>Hardwired and microprogrammed control: microprogrammed sequencing, wide branch addressing, and micro-instruction with next address field, pre-fetching microinstructions, concept of horizontal and vertical microprogramming.</p>	8
3.	<p>Central Processing Unit: Addition and subtraction of signed numbers look ahead carry adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Processor organization, general register organization, stack organization and addressing modes.</p>	9
4.	<p>Input/Output organization: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions.</p>	4
5	<p>Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access. I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.</p>	5
6.	<p>Memory: Basic concept and hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memories: concept and design issues, associative mapping, direct mapping, set-associative mapping, cache writing and initialization.</p>	8
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Master's Theorem,	6
2.	Searching and Sorting: Structure of divide-and-conquer algorithms; examples: binary search, quick sort, Strassen Matrix Multiplication; merge sort, heap sort and Analysis of divide and conquer run time recurrence relations.	7
3.	Greedy Method: Overview of the greedy paradigm examples of exact optimization solution: minimum cost spanning tree, approximate solutions: Knapsack problem, Kruskal's algorithm and Prim's algorithm for finding Minimum cost Spanning Trees, Dijkstra's and Bellman Ford Algorithm for finding Single source shortest paths, Huffman coding, Activity Selection Problem.	8
4.	Dynamic programming: Principles of dynamic programming. Applications: Rod cutting problem, Floyd-Warshall algorithm for all pair shortest paths. Matrix multiplication, Travelling salesman Problem, Longest Common sequence, Back tracking: Overview, 8-queen problem, and Knapsack problem, Traveling Salesman problem.	7
5.	Branch and bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem	6
6.	Computational Complexity: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples: Circuit Satisfiability, Vertex cover, Subset Sum problem, Randomized Algorithms, String Matching, NP-Hard and NP-Completeness, Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials and FFT, Number Theoretic Algorithms.	8
TOTAL		42

10. Details of Course:

S.No.	Detail Contents	Contact Hours
1	Definition of management, importance of management, management principals, managerial roles, managerial ethos, management vs administration, managerial functions, task and responsibilities, organizational structure, motivation: meaning, theories and techniques.	8
2	Concept of business environment, corporate social responsibility and corporate governance, managerial values and ethics.	8
3	Objectives and importance of financial management, basics of capital budgeting, cost of capital, emerging sources of funds for new projects, introduction to stock market.	9
4	Functions of marketing, marketing Vssales, interface of marketing with other departments, customer life time value, new product development, unethical issues in marketing.	8
5	Introduction to knowledge management, knowledge society, knowledge economy, building knowledge assets, sources of knowledge, technology innovation process, E-governance: definition, objectives and significance; challenges in Indian context, Digital India programme.	9
Total		42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,(ISBN:9780273755869),2011
2	Financial Accounting, 4 ed, S.N. Maheshwari and S.K. Maheshwari, VikasPulication,(ISBN:8125918523), 2005
3.	Management, JamesAF Stonner, Pearson Education,(ISBN: 9788131707043),2010
4.	Marketing Management, 14 th ed., Philip Kotler , Kevin Lane Keller, Abraham Koshy and MithileswarJha, Pearson Education, (ISBN: 9788131767160), 2013
5	Knowledge Management in Organizations: A Critical Introduction, Donald Hislop, Oxford University Press, ISBN: 9780199691937,2013

4.	Software project Management: Project planning and Project scheduling. Software Metrics: Size Metrics like LOC, Token Count, Function Count. Cost estimation using models like COCOMO. Risk management activities. Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability models, Software quality, ISO 9000 certification for software industry, SEI capability maturity model.	8
5.	Testing: Verification and validation, code inspection, test plan, test case specification. Level of testing: Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging. functional testing, structural testing, Software testing strategies.	8
6.	Software Maintenance: Structured Vs unstructured maintenance, Maintenance Models, Configuration Management, Reverse Engineering, Software Re-engineering.	4
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books	
1.	R. S. Pressman, "Software Engineering – A practitioner's approach", 3 rd ed., McGraw Hill Int. Ed,1992
Reference Books	
1.	K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2 nd Ed., New Age International,2005
2.	Sommerville, "Software Engineering", Addison Wesley,2001

1. Subject Code: **CO 303** Course Title: **Theory of Computation**
2. Contact Hours : L: 3 T: 1 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits : 4

6. Semester : V
7. Subject Area : DCC
8. Pre-requisite : Elementary set theory, Relations, Mappings, and some abstract algebra
9. Objective : To provide knowledge and skills in theoretical foundations of computing that are needed to study and practice computer science.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.	8
2.	Regular expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.	8
3.	Context free grammar (CFG): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF,	6
4.	Context Free Languages (CFL): Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.	6

5.	Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.	6
6.	Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.	10
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1	Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education. ISBN-13: 978-0321455369, 2006
2	K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science Automata, Languages and Computation", PHI, ISBN-10: 8120329686, 2007
Reference Books	
1.	Martin J. C., "Introduction to Languages and Theory of Computations", TMH, ISBN 978-0-07-319146-1, 2010
2.	Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI, ISBN-13: 978-0132624787
3.	Peter Linz, "An Introduction to Formal Language and Automata", Third Edition, Narosa Publishers, New Delhi, ISBN 0-7637-142
4.	Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, ISBN 978-81-317-2356-2

1. Subject Code: **HU303** Course Title: **Professional Ethics and Human Values**
2. Contact Hours : L: 2 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits : 2
6. Semester : V
7. Subject Area : HMC
8. Pre-requisite : NIL
9. Objectives : To make students aware of the ethics and codes of conduct required by Engineers and Professionals.

10. Details of Course:

S.No.	Name of Books, Authors, Publishers	Contact Hours
1.	Human Values and Ethics: Morals, Values, Ethics and Integrity, Need for Value Education for Engineers, Happiness, Prosperity, Harmony.	6
2.	Code of Ethics and Professionalism: Professionalism and the Code of Ethics, Technical Education, Human Values and Coexistence, Universal Human Order, Natural acceptance.	6
3.	Professional Ethics and Technology :Science, Technology and Professional EthicsEngineering Ethics, Environmental Ethics, Safety, Responsibility and Rights.	8
4.	Case Studies: Holistic Technologies, Eco-friendly production systems, The role of responsible engineers and technologists, Global Issues concerning Engineers.	8
TOTAL		28

11. Suggested Books

S.No.	Name of Books/ Authors/ Publishers/ Year of Publication/ Reprint
1	Professional Ethics, Subramanian, R, Oxford University Press, ISBN13: 978-0-19-808634-5,2011
2	Professional Ethics and Human Values, Govindarajan, M. S. Natarajan, V.S. Senthilkumar PHI, ISBN: 978-81-203-4816-5, 2013
3	Constitution of India and Professional Ethics, Reddy, G.B. and Mohd. Suhaib, IK International Publishing House. ISBN: 81-89866-01-X, 2006
4	Introduction to Engineering Ethics (2nd Ed.) Martin, Mike W. and Roland Schingzinger McGraw-Hill ISBN 978-0-07-248311-6, 2010

1. Subject Code: **CO302** Course Title: **Compiler Design**
2. Contact Hours : L: 3 T: 0 P: 2
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits : 4
6. Semester : VI
7. Subject Area : DCC
8. Pre-requisite : Theory of Computation
9. Objective : To study the design of all the phases of compiler in detail.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Definition, Phases and Passes, FSM & RE's and their application to Lexical Analysis, Implementation of Lexical Analyzers, Lexical- Analyzer Generator, Lex – Compiler.	6

2.	Syntax Analysis: Formal Grammar and their application to Syntax Analysis, BNF Notation,. The Syntactic specification of Languages: CFG, Derivation and Parse Trees, Shift Reduce Parsing, Operator precedence parsing, top down Parsing, Predictive Parsers. LR Parsers, the canonical collection of LR(0)items, constructing SLR Parsing Tables, Constructing canonical LR Parsing tables and LALR parsing tables , An Automatic Parser Generator, YACC.	12
3.	Syntax Directed Translation: Syntax directed Translation Schemes, Implementation of Syntax directed translators, Intermediate Code, Postfix notation, Parse Trees and Syntax Trees, Three address Code, Quadruple & Triples, Translation of Assignment Statements, Boolean expressions, Control Statements, Array references in Arithmetic expressions , Procedure Calls , Declarations and Case statements Translations.	10
4.	Symbol Tables: Data Structure for Symbol Tables, representing scope information. Run Time Administration: Implementation of simple Stack allocation scheme, storage allocation in block structured language.	4
5.	Error detection and Recovery: Lexical phase errors, syntax phase errors, semantic errors and Error recovery techniques.	4
6.	Code Optimization: Loop optimization, the DAG representation of basic blocks, value numbers and Algebraic Laws, Global Data – Flow Analysis and Code generation.	6
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Aho,Ullman & Sethi, “Compiler Design”, Addison Wesley,ISBN 81-7808-046-X,2004
Reference Books	
1.	D.M.Dhamdhare, “Compiler Construction – Principles & Practice”Macmillan India, ISBN 0333904060,2000

1. Subject Code: **CO 304** Course Title: **Artificial Intelligence**
2. Contact Hours : L: 3 T: 1 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS - MTE 25 ETE 50 PR 0
5. Credits : 4
6. Semester : VI
7. Subject Area : DCC
8. Pre-requisite : Discrete mathematics, Programming, Probability & Graph Theory
9. Objective : To introduce basic Knowledge representation, problem solving, and learning methods of Artificial Intelligence and understand the role of knowledge representation, problem solving, and learning in intelligent system engineering.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: AI Problems, Task Domains of AI, AI Techniques: search knowledge, abstraction. Introduction to Intelligent program and Intelligent agents. Problem Solving: Basic Problem solving Method: state space search, problem characteristics, Production systems characteristics, issues in design of Intelligent search algorithm.	6
2.	Heuristic search Techniques: Hill climbing techniques, Best First search, A* Search, Problem Reduction: AO* Search, Constraint Satisfaction, Means-End Analysis. Game Playing: Game Tree, Searching procedure Minimax, alpha-beta pruning	7

3.	Knowledge Representation: Knowledge Representation issues. Knowledge Representation using Predicate Logic: Unification, resolution. Rule based Systems: Forward versus backward reasoning, conflict resolution. Structured Knowledge Representation: Semantic Nets, Frames, conceptual dependency, scripts.	7
4.	Programming Languages: Fundamental and concepts of Programming languages like Prolog or Lisp. Relationship of languages with Knowledge representation and inferences	6
5.	Reasoning: Handling uncertainty Non-Monotonic Reasoning, Probabilistic reasoning, use of certainty factors, fuzzy logic. Learning Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.	8
6.	Applications: Expert Systems: Architecture, Domain Knowledge, Knowledge Acquisition, Case Studies: MYCIN, RI, Natural language Processing: Syntactic, Semantic and Pragmatic Analysis, Robotics etc.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Artificial Intelligence, E. Rich and K. Knight, TMH, 2nd ed.(ISBN- 978-0070522633),1992
2.	Principles of AI, N.J. Nilsson, , Narosa Publ. House, (ISBN: 978-81-85198-29-3),1990
Reference Books	
1.	"Neural Networks in Computer Intelligence" by KM Fu, McGraw Hill (ISBN- 978-0136042594),1992
2.	Artificial Intelligence: Structures and Strategies for Complex Problem Solving (5th Edition), George F. Luger, 2005. Addison-Wesley. (ISBN: 978-8131723272)
3.	Artificial Intelligence: A Guide to Intelligent Systems (2nd Edition).Michael Negnevitsky, 2005. Addison-Wesley. (ISBN: 978-8131720493)
4.	"Introduction to AI and Expert Systems", D.W. Patterson, , PHI, 1992(ISBN: 978-0134771007)

10. Details of Course:

S. No.	Contents	Contact Hours
1.	English for Professional Purposes: 1. Technical Communication- Methods, Strategies and Skills 2. Communication in Global Contexts- Social, Cultural, Political and Technical, especially in formal set up	1 2
2.	Communication at the Workplace: Oral and Written: 1. Written Communication- Letters, Orders (Sale/Purchase) Report Writing, Technical proposals Resume, SOP, Memo, Notice, Agenda, Minutes, Note Taking/Making, 2. Oral Communication: Seminars, Conferences, Meetings, Office Etiquettes/ Netiquettes, Presenting Written Material Negotiation, Demonstration, Group Discussion, Interview	6 6
3.	Group Discussion and Report Writing: 1. Group Discussion (Continuous assessment through the semester) 2. Minor Report Writing(to be submitted before Mid- Semester Examination) 3. Major Report writing (To be submitted 4. before End Semester Examination)	13
Total		28

11. Suggested Books

S.No.	Name of Books/ Authors/ Publishers/ Year of Publication/ Reprint
1.	Technical Communication: Principles and Practice Raman, Meenakshi and Sangeeta Sharma, Oxford University Press, ISBN-13: 978-0-19-806529-6, 2011, Reprinted 2014
2.	Writing to Get Results, (3rd Ed) Blicq, Ron S., Lisa A. Moretto, John Wiley and Sons, Inc. ISBN 0-7803-6020-6, 2001
3.	Effective Technical Communication: A Guide for Scientists and Engineers , Mitra, Barun K. OUP: Delhi ISBN-13: 978-0-19-568291-5, 2006
4.	Personality Development and Soft Skills, Mitra, Barun K. New Delhi:Oxford University Press.ISBN-9780198060017, 2014

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Need for security, Introduction to security attacks, services and mechanism, introduction to cryptography, Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers, Intruders, Viruses and related threads.	8
2.	Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, Fiestal structure, data encryption standard(DES), strength of DES, crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, key distribution.	6
3.	Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primarily testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms, Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elgamal encryption.	10
4.	Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code (MAC), hash functions, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA), Public Key Infrastructure(PKI): Digital Certificate, private key management, Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.	6
5.	Authentication Applications: Kerberos and X.509, directory authentication service, password, challenge-response, biometric authentication, electronic mail security-pretty good privacy (PGP), S/ MIME.	6
6.	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money, WAP security, firewall design principals, Virtual Private Network (VPN) security.	6
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to Distributed Systems, Design Goals, Types of Distributed systems, system architectures and fundamental models, middleware, Threads, virtualization, client-Server Model, Code migration	7
2.	Communication fundamentals, Remote Procedure Call, message oriented communication, and stream oriented communication, multicast communication	7
3.	Synchronization: clock synchronization, logical clocks, mutual exclusion algorithms: centralized, decentralized, distributed and token ring algorithms, election algorithms.	6
4.	Replication management: need for replication, consistency models: data centric and client centric consistency models, replica management, consistency protocols: continuous, primary-based, replicated-write and cache-coherence protocols.	8
5.	Fault tolerance: basic concepts and failure models, process resilience, reliable client-server and group communication, distributed commit recovery mechanisms	6
6.	Security in distributed systems, secure channels, authentication, integrity and confidentiality, access control, security management. Naming: Flat naming approaches, structured naming, name space and resolution, attribute- based naming, directory services, LDAP, decentralized implementations.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Distributed Systems, Principles and Paradigms, 2nd edition by Andrew S. Tanenbaum and Maarten Van Steen, Pearson Education, (ISBN-13: 978-0132392273), 2013

7. Subject Area : DCC
8. Pre-requisite : Database Management System
9. Objective : To introduce the concept of Data Warehousing and Data Mining, respective techniques and applications in real world scenario.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Data Warehousing: - Basic concepts in data warehousing, Collecting the requirements of data warehouse, Data Warehouse Architecture, Design, Implementation & Maintenance, OLAP in data warehouse, Data warehousing and the web, Data Cube Technology, From Data Warehousing to Data Mining.	8
2.	Data Mining Concepts: Data mining primitives, Basics of data mining, Query language, Architectures of data mining systems	6
3.	Mining Association Rules in Large Databases: Association Rule Mining, Mining Single Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint Based Association Mining.	8
4.	Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.	8
5.	Cluster Analysis in Data Mining: Types of Data in Cluster Analysis. A Categorization of Major Clustering Methods, Partitioning Methods, Density Based Methods, Grid Based Methods; Model Based Clustering Methods, Outlier Analysis	6

6.	Mining Complex Types of Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time Series and Sequence Data, Mining Text Databases. Applications and trends in Data Mining: - Applications, Systems products and research prototypes, Additional themes in data mining, Trends in Data mining, spatial mining, and Web Mining.	6
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books:	
1	Data Warehousing Fundamentals, P. Ponnian, John Wiley,
2	Data Mining Introductory & Advanced Topics, M.H. Dunham, Pearson Education, 2011 (Reprint), 2012(Tenth Impression)
3	Data Mining Concepts & Techniques, Han Kamber, M. Kaufman, 2 nd ed, 2011 (Reprint)
Reference Book:	
1	The Data Warehouse Lifecycle Tool Kit, Ralph Kimball, John Wiley
2	Master in Data Mining, M. Berry , G. Linoff, John Wiley
3	Building the Data Ware houses, W.H. Inmon, Wiley Dreamtech

DEPARTMENTAL ELECTIVES

9. Objective : Familiarize the students with Digital Signal Processing, treatment of audio signals, time domain and the frequency domain representation of signals, digital filtering, noise in signals.

10. Details of Course

S.No.	Contents	Contact Hours
1.	INTRODUCTION: Introduction to Signal-continuous time and Discrete time signals and systems, characteristics of discrete time sinusoidal signals. Discrete –time description of signals and systems: Representation of elementary sequences, signal classification, basic operations, classification of discrete time systems. linear convolution.	6
2.	FREQUENCY DOMAIN REPRESENTATION OF DISCRETE –TIME SIGNAL AND SYSTEMS: Discrete time Fourier transform (DTFT). Different properties of DTFT. Frequency domain representation of linear time invariant system.	6
3.	DISCRETE FOURIER TRANSFORM (DFT): Introduction, Fourier representation of periodic signal DFT, properties of DFT. Linear convolution using the DFT FAST FOURIER TRANSFORM(FFT): Decimation- in- time and Decimation- in-frequency, FFT Algorithms(Radix 2 only).	10
4	.Z-TRANSFORM: Introduction, region of convergence for the Z-transform. The Inverse Z-transform. The Inverse Z-transform. One sided Z-transform. Solution of difference equation using Z-transform. System function.	6
5	REALIZATION OF DIGITAL SYSTEMS: System describe by difference equation, recursive and non-recursive systems, linear constant coefficient difference equation, Finite Impulse Response(FIR) and Inline Impulse Response (IIR) systems, Direct, cascaded and parallel form structure for IIR system. Direct and cascaded form structure for FIR system	6
6.	IIR FILTER DESIGN: Impulse invariance, Bilinear transform method, Butterworth filter. FIR FILTER DESIGN: FIR versus IIR, Linear phase FIR filter, FIR filter design by Rectangular, Hanning and Hamming window.	8
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	ADVANCED TREES: Definitions Operations on Weight Balanced Trees (Huffman Trees), Height balanced trees- B trees, B+ trees, 2-3 Trees and Red-Black Trees. Augmenting Red-Black Trees to Dynamic Order Statics and Interval Tree and Applications. Operations on Disjoint sets and its union find problem, Implementing Sets. Dictionaries, Priority Queues and Concatenable Queues using 2-3 Trees,.	8
2.	MERGEABLE HEAPS: Mergeable Heap Operations, Binomial Trees Implementing Binomial Heaps and its Operations, 2-3-4. Trees and 2-3-4 Heaps. Structure and Potential Function of Fibonacci Heap Implementing Fibonacci Heap.	9
3.	GRAPH THEORY DEFINITIONS: Definitions of Isomorphism Components. Circuits, Fundamental Circuits, Cut-sets. Cut-Vertices Planer and Dual graphs, Spanning Trees, Kuratovski's two Graphs.	8
4.	GRAPH THEORY ALGORITHMS: Algorithms for Connectedness, Finding all Spanning Trees in a Weighted Graph and Planarity Testing, all pair shortest path algorithms. Min-Cut Max-Flow theorem of Network Flows. Ford-Fulkerson Max Flow Algorithms.	7
5	Tries/digital search trees, Multiway tries, Suffix trees and applications, Quadrees and Octrees and R-trees	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books:	
1	NarsinghDeo-Graph Theory with Application to Engineering and Computer Science,Prentice Hall of India.
2	Baase-Computer Algorithms, Pearson Education.
3	Cormen-Introduction to Algorithms, Prentice Hall of India.
Reference Book:	

3.	16-bit Microprocessor: Architecture of 8086 microprocessor: register organization, bus interface unit, execution unit, memory addressing, memory segmentation. Operating modes. Instruction sets, instruction format, Types of instructions. Interrupts: hardware and software interrupts.	8
4.	Programming: Assembly language programming based on Intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions	8
5.	Peripheral Interfacing: Peripheral Devices: 8237/8257 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.	10
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books:	
1.	Gaonkar Ramesh S, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publishing.
2.	Ray A K , Bhurchandi K M , "Advanced Microprocessors and Peripherals, TMH
3.	Hall D V, "Microprocessor Interfacing", TMH.
Reference Books:	
1	Liu and Gibson G A , Microcomputer System: The 8086/8088 family ,PHI
2	Aditya P Mathur, Introduction to Microprocessor, TMH
3	Brey, Barry B, INTEL Microprocessors, PHI
4	Renu Sigh & B.P.Sigh, Microprocessor, Interfacing and Application

4.	Two dimensional viewing: The viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Barky line clipping algorithm, Algorithm for polygon clipping, Sutherland-Hodgeman polygon clipping, Wailer-Atherton polygon clipping, curve clipping, Text clipping.	8
5	Curves and Surfaces: Representation of surfaces, polygon meshes, plane equations, parametric cubic curves, Hermite Curves, Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, Conditions for smoothly joining curve segments, Bezier bi-cubic surface patch, B-Spline Curves, Cubic B-Spline curves using uniform knot vectors, Testing for first and second order continuities	6
6	Projection: Parallel Projection, Oblique Projection on XY plane, Isometric Projection, Perspective Projection, One Vanishing Point (V.P.) projection, Generation of 2 V.P. Projection, planar geometric projections. Shading and Hidden Surface Removal: Shading, Illumination Model for diffused Reflection, Effect of ambient lighting, distances, Specular Reflection Model, Computing Reflection Vector, Curved Surfaces, Polygonal Approximations, Guard Shading, Phong Model, Hidden Surface Removal, Back Face Detection, Depth Buffer (Z-Buffer, A-Buffer) Method, Scan Line Method, Depth Sorting Method, Area Subdivision Method.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books:	
1.	D. Hearn , P. Baker& W. Carithers, "Computer Graphics with OpenGL", Pearson, 2015
2.	Z. Xiang & R. Plastock "Computer Graphics", Schaum's Series, McGraw Hill, 2007
3.	David F. Rogers, "Procedural Elements for Computer Graphics", Tata McGraw Hill Book Company, 2002
Reference Books:	
1.	D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw- Hill International Edition, 2002
2.	Foley et al., "Computer Graphics Principles & practice", Addison Wesley, 1999

4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits : 4
6. Semester : V
7. Subject Area : DEC
8. Pre-requisite : Discrete Mathematics
9. Objective : The course integrates the concepts of fuzzy logic, neural networks and optimization techniques for understanding the complex nature of decisions taken by human beings which incorporates partial understanding of the truth with past experience. At the end of this course the student should be able to understand the basic techniques used in soft computing and apply them to solve real world problems.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms- Perceptrons, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.	8
2.	Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.	7
3.	Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets	6
4.	Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	6

7. Subject Area : DEC
8. Pre-requisite : Nil
9. Objective : To introduce fundamentals of Enterprise Java Programming, concepts of program development using beans.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Collections : Collection Interfaces, Concrete Collections, Collections Framework. Multithreading : Creating and running thread, Multiple thread synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.	5
2.	Fundamentals in Networking: Sockets in Java - Internet Addressing - DNS – Ipv4, IPv6- URL class - TCP/IP and Datagram. The interfaces and classes for networking : Interfaces and classes of java.net package; InetAddress class : IP address scope - Host name resolution - Methods of InetAddress class; Program to look up the IP addresses for a hostname - Factory methods - Creating and using Sockets : Socket class - constructors and methods of Socket class. Creating TCP servers & clients : TCP/IP server sockets - Constructors and methods of ServerSocket class - Program to create a TCP/IP server and client. Handling URL: URL class - constructors and methods of URL class -URLConnection class - fields of URLConnection class - methods of URLConnection class. Working with Datagrams: DatagramPacket - Constructors for DatagramPacket class - Methods of DatagramPacket class - creating Datagram server and client.	6
3.	JDBC Package :JDBC – JDBC versus ODBC – Types of JDBC drivers – Connection – Statement – PreparedStatement. ResultSet :Fields of ResultSet – Methods of ResultSet – Executing a query - ResultSetMetaData – DatabaseMetaData. Datatypes in JDBC : Basic datatypes in JDBC – Advanced datatypes in JDBC – fields of Statement – methods of Statement – CallableStatement Interface – BatchUpdates	6

4.	<p>Servlets : Using Servlets - Servlet Package - Servlet lifecycle - init() method - service() method , doGet() method, doPost() method and destroy() method . Classes and interfaces of Servlet: Servlet - GenericServlet - ServletConfig - ServletContext - ServletException - ServletInputStream - ServletOutputStream - ServletRequest – ServletResponse. Classes and interfaces of HttpServlet: HttpServlet - HttpServletRequest - HttpServletResponse - Reading HTML form data from Servlets - Response Headers - Response Redirection. Handling Servlets : Servlet Chaining - HttpUtils - Database access with JDBC inside servlet. State and Session management : Cookies - HttpSession - Server Side includes - Request forwarding – RequestDispatcher.</p>	7
5.	<p>Concepts of Java Beans: Java Beans - Advantage of Java Beans - Reflection and Introspection - Customizers – Persistence. Developing Java Beans : Bean Developer Kit (BDK) - Creating a Java Bean - Creating a Bean Manifest file - Creating a Bean JAR file. Controls and Properties of a Bean : Adding controls to Beans - Giving Bean Properties - BeanInfo interface - SimpleBeanInfo class. Types of Properties: Design pattern for Properties: Simple properties - Indexed Properties; Descriptor Classes - Giving Bean methods - Bound and Constrained Properties - Property Editors.</p>	9
6.	<p>Components of EnterpriseBeans : Distributed Multitiered Applications -J2EE components: J2EE clients, Web components, J2EE containers. Developing an Enterprise Bean : Packaging - Enterprise JavaBeans Technology - Enterprise Bean - Contents of an Enterprise Bean. Session Bean : Stateful session bean – life cycle of stateful session bean - Stateless session bean – life cycle of stateless session – ejbCreate methods – Business methods – Home interface – Remote interface – Running the session bean. Entity Bean :Persistence - Bean managed Persistence - Container Managed Persistence - Shared Access - Primary key – Relationships. Message Driven Bean :life cycle of message driven bean – onMessage method.</p>	9
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction Evolution of embedded systems & their applications, architectural diversity for embedded system development.	6
2.	Techniques and tools for embedded software development Embedded Programming principles, Instruction Set Architectures for embedded software development: arithmetic and logical, program control, string instructions, special or privileged instructions.	8
3.	Interrupt system , Input-output programming, Memory management, Using High level languages for embedded programming, structured and Object Oriented Programming.	7
4.	Re-configurable FPGA for embedded computing R-FPGA and hardware software development, issues in Reconfigurable computing, placement and scheduling techniques.	8
5.	Design of digital systems on FPGAs, fault tolerant design on FPGAs, Re-targetable assembling and compilation.	7
6.	Applications Specific applications, Emerging trends.	6
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
TEXTBOOKS	
1.	Advanced FPGA Design: Architecture, Implementation, and Optimization by Steve Kilts, Wiley. (ISBN- 978-0-470-05437-6), 2007
2.	Practical FPGA Programming in C by David Pellerin, Prentice Hall. (ISBN-10: 0131543180, ISBN-13: 978-0131543188), 2005

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical <i>Preliminaries</i> for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.	6
2.	Huffman coding: The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, encoding procedure, decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.	8
3.	Arithmetic Coding: Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress.	12
4.	Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows- Wheeler Transform: Move-to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markov Compression.	8
5.	Mathematical Preliminaries for Lossy Coding: Distortion criteria, Models, Scalar Quantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.	4
6.	Vector Quantization: Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo- Gray Algorithm, Tree structured Vector Quantizers. Structured <i>Vector</i> Quantizers.	4
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to Probability theory: Through set and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability and Axioms, Probability as a Relative Frequency, Joint and Conditional Probability: Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem. Independent Events: Two Events, Multiple Events, Properties of Independent Events.	6
2.	Random Variables: Random Variable Concept, Definition of a Random Variable, Conditions for a Function to Be a Random Variable, Discrete and Continuous Random Variables, Mixed Random Variable. Distribution Function, Density Function: Existence, Properties of Density Functions. Gaussian Random Variable: Other Distribution and Density Examples: Binomial, Poisson, Uniform, Exponential, Rayleigh. Conditional Distribution and Density Functions: Conditional Distribution, Properties of Conditional Distribution, Conditional Density, Properties of Conditional Density.	8
3.	Operations on Random Variables: Expectation, Expected Value of a Random Variable, Expected Value of a Function of a Random Variable, Conditional Expected Value, Moments, Moments about the Origin, Central Moments, Variance and Skew / Chebychev's Inequality / Markov's Inequality, Chernoff's Inequality and Bound.	6
4.	Multiple Random Variables, Vector Random Variables, Joint Distribution and Its Properties, Joint Distribution Function, Properties of the Joint Distribution, Marginal Distribution Functions, Joint Density and Its Properties, Joint Density Function, Properties of the Joint Density, Marginal Density Functions, Conditional Distribution and Density, Statistical Independence, Distribution and Density of a Sum of Random Variables.	6
5.	Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions. Descriptive Statistics: Graphical representation, measures of locations and variability. Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.	8

9. Objective : To introduce parallel algorithms and compare it with its sequential equivalent.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Need for parallel computers ,Models of computation,Analyzing parallel algorithms, Expressing parallel algorithms	3
2.	Dense Matrix algorithms: Matrix vector Multiplication, Matrix multiplication	4
3.	Decomposition & Mapping techniques: Database query processing, 15 puzzle problem, Parallel discrete event simulation, Image dithering, Dense LU factorization	5
4.	Sorting : Hyper quick sort, Merge sort, Bitonic merge sort, odd even transposition, Enumeration sort(sorting on the CRCW model, CREW model and EREW model)	10
5.	Searching and selection: Searching on a sorted sequence (EREW,CREW,CRCW), Searching on a random sequence (EREW, CREW, CRCW, Tree and Mesh), Sequential selection algorithm, Parallel selection algorithm(EREW parallel solution)	10
6.	Graph Algorithm: Graph coloring ,Minimal spanning tree , Shortest path algorithm	10
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
1.	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar "Introduction to Parallel Computing", Second Edition, Addison Wesley, ISBN: 0-201-64865, 2003
2.	S.G. Akl, "The Design and Analysis of Parallel Algorithms", PHI. ISBN-10: 0132000563, 1989
3.	F.T. Leighton, "Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes", MK Publishers, San Mateo California./ISBN:1-55860-117-1, 1992

2.	Image Enhancement (Spatial Domain): Gray level transforms, histogram equalization, histogram specification, basics of the spatial filtering, smoothing operators, image gradients, sharpening operators Fuzzy logic: basic definitions, fuzzy operations, fuzzy inference, application of fuzzy logic in image processing.	7
3.	Image Enhancement (Frequency domain): Two-Dimensional Fourier transform and its properties, basics of frequency domain filtering, smoothing and sharpening in frequency domain.	7
4.	Image Restoration: modelling of image degradations, noise models, noise removal algorithms for impulse and Gaussian noise, Adaptive filtering, estimation of degradation function, inverse filtering. Color Image Processing: Color models, conversion between different models, color transforms, color smoothing and sharpening	8
5.	Morphological Image Processing: Dilation, Erosion, opening and closing, hit and miss transform, boundary extraction, region filling, thinning, thickening, skeletons, pruning, Gray scale image dilation and erosion.	6
6.	Discontinuity Detection: point, line and edge detection, Sobel, Canny, and LoG edge detectors, edge linking. Image Segmentation: Thresholding, optimal and global thresholding, multiple thresholding, region growing, region splitting and merging, dam construction watershed segmentation algorithm, spatial techniques, frequency domain techniques	8
TOTAL		42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing', 3 rd Edition, Pearson Education, SBN-13: 978-0131687288, 2008

3.	Transmitter and Receivers: Classification of radio transmitters, Block diagram of AM transmitter, Frequency Scintillation, Frequency Drifts, Radio broadcast transmitter. Armstrong FM transmitter, Simple FM transmitter- using reactance modulator, classification of radio receivers, TRF receivers, super heterodyne receivers, image signal rejection, frequency mixers, tracking and alignment of receivers, intermediate frequency, AGC, AFC, SSB receivers.	8
4.	Pulse Analog Modulation: Sampling theorem, Sampling of Low Pass and band pass signals, Aliasing, Aperture effect, PAM, PWM and PPM generation and modulation, TDM, Cross talk, Spectral analysis of PAM, PWM and PPM Waves, S/N ratio for different pulse modulation.	6
5.	Pulse Digital Modulation: Pulse Code Modulation signal to quantization noise ratio, Companding, Probability of error for PCM in AWGN Channel, DPCM, DM and ADM modulators and demodulators, Prediction Filter, line coding, Inter symbol Interference.	8
6.	Digital transmission through carrier modulation: Amplitude, Frequency and phase shift keying, differential phase shift keying, CPFSK, MSK, QPSK and QAM modulation & detection, probability of error calculation, Matched Filter.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Simon Haykins, "Communication Systems", John Wiley, 5 th Edition, ISBN: 978-1-118-83668-2, 2013
2.	Taub & Schilling, "Principles of Communication Systems", 3 rd Ed. TMH, ISBN: 0070648115, 2008
Reference Books	
1.	Kennedy, " Electronic Communication Systems", 5 th Ed., ISBN: 9780071077828, 2012
2.	B. P. Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, 4 th Ed. Oxford University Press, ISBN 13: 9780195331455, 2009

8. Pre-requisite : Computer Networks
9. Objective : To highlight the features of different technologies involved in High Speed Networking and their performance

10. Details of Course

S.No.	Contents	Contact Hours
1.	High Speed networks: Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11	8
2.	Congestion And Traffic Management: Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks	6
3.	TCP And ATM Congestion Control : TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management	8
4.	INTEGRATED AND DIFFERENTIAL SERVICES Integrated Services Architecture - Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ - Random Early Detection, Differentiated Services	6
5.	PROTOCOLS FOR QOS SUPPORT RSVP - Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms - Multiprotocol Label Switching - Operations, Label Stacking, Protocol details - RTP - Protocol Architecture, Data Transfer Protocol, RTCP.	6

8. Pre-requisite : Database Management Systems
9. Objective : To highlight the features of advanced SQL, parallel and distributed databases and architecture of modern database systems.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Advanced SQL : SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. Object-Based Databases and XML: Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Oriented versus Object-Relational, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications.	8
2.	Query Processing and Query Optimization: Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.	6
3.	Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.	6
4.	Database-System Architectures: Centralized and Client –Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types, Parallel Databases, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Design of Parallel Systems.	8
5.	Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases.	6

7. Subject Area : DEC
8. Pre-requisite : Nil
9. Objective : To study the concepts of multimedia data, algorithms and compression.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment Products, Stages of Multimedia Projects: Multimedia hardware, Memory & storage devices, Communication devices, Multimedia softwares, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.	9
2.	Multimedia Building Blocks: Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment, Audio & Video Capture.	6
3.	Data Compression: Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modeling. Finite Context Modeling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.	9
4.	Speech Compression & Synthesis : Digital Audio concepts, Sampling Variables, Loss less compression of sound, lossy compression & silence compression.	6
5.	Images: Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file formats, animations, Images standards, JPEG Compression, Zigzag Coding,	5
6.	Multimedia Database. Content based retrieval for text and images, Video: Video representation, Colors, Video Compression, MPEG standards, MHEG Standard Video Streaming on net, Video Conferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database, recent developments in Multimedia.	7
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction : Definition, Typical Real Time Applications; Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	8
2.	Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	10
3.	Resources Access Control: Effect of Resource Contention and Resource Access Control (RAC), Non preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects	8
4.	Multiprocessor System Environment : Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.	8
5.	Real Time Communication : Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.	8
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Pattern recognition fundamentals: Basic concepts of pattern recognition, fundamental problems in pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple automatic pattern recognition model.	6
2.	Bayesian decision theory: Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, Discrete features, Missing and noisy features.	6
3.	Maximum-likelihood and Bayesian parameter estimation:Maximum-Likelihood estimation: Gaussian case, Maximum a Posteriori estimation, Bayesian estimation: Gaussian case, Problems of dimensionality, Dimensionality reduction: Principle component analysis.	6
4.	Non-parametric techniques for density estimation: Parzen-window method, K-Nearest Neighbour method, Fuzzy classifications. Unsupervised learning and Clustering: k-mean clustering, fuzzy k-mean clustering, similarity measures, criterion functions for clustering, hierarchical clustering.	8
5.	Neural Network Classifiers: Single and Multilayer Perceptron, Feedforward operations and classifications, network learning, training protocols,Back Propagation Learning, Bayes discriminants and neural networks.	6
6.	Stochastic Methods: Stochastic search, Boltzmann factor, simulated annealing algorithm, deterministic simulated annealing, Boltzmann learning. Evolutionary Methods: Genetic algorithms, genetic programming, particle swarm optimization.	8
TOTAL		42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	R. O. Duda, P. Hart, D. Stork, Pattern Classification, 2 nd Ed. Wiley, ISBN: 978-0-471-05669-0, 2000
2.	Bishop, C. M., Pattern Recognition and Machine Learning. Springer, ISBN 978-0-387-31073-2, 2007
3.	Bishop, C. M., Neural Networks for Pattern Recognition, Oxford University Press, ISBN-13: 978-0198538646, 1995
Reference Books	
1.	Theodoridis, S. and Koutroumbas, K., Pattern Recognition, 4 th Ed. Academic Press, SBN :9781597492720, 2008
2.	Hastie, T., Tibshirani, R. and Friedman, J., The Elements of Statistical Learning, Springer, ISBN:9780387848570, 2009

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|--------------------------------------|--------------|---|---|
| 1. Subject Code: | CO326 | Course Title: | Object Oriented Software Engineering |
| 2. Contact Hours | : | L: 3 | T: 0 P: 2 |
| 3. Examination Duration (ETE)(Hrs.) | : | Theory 3 Hrs | Practical 0 |
| 4. Relative Weightage | : | CWS 15 PRS 15 | MTE 30 ETE 40 PR 0 |
| 5. Credits | : | 4 | |
| 6. Semester | : | VI | |
| 7. Subject Area | : | DEC | |
| 8. Pre-requisite | : | Nil | |
| 9. Objective | : | To understand basic methodology of object oriented software engineering and learn to create UML diagrams at various phases of software development life cycle using real-life case studies. | |

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Object Oriented system concepts and Principles, Object Oriented system development, Component reuse, The common process framework for Object Oriented processes, System Development and Methodologies, object oriented software estimation.	6
2.	System development: System as model building, model architecture, The importance of modelling, principle of modelling, object oriented modelling, Introduction to Object-oriented Methodologies such as Unified Modelling Language, Overview of UML, conceptual model of UML, architecture, software development lifecycle using Rational Unified Process.	8
3.	Object Oriented Analysis: requirement model, analysis model, Object oriented analysis using methods of Rumbaugh.	6
4.	Software Design: Software design Models, Object oriented methodologies of Booch, design model, System development using various UML Diagrams.	6
5.	UML Methodology: Detailed study of various UML Diagrams, System Analysis using UML Diagrams.	8
6.	Object Oriented Testing and metrics: Path Testing, State based testing, Class Testing, object oriented metrics. Applications & Tools: A complete case study of Software development using above Methodologies, Concepts of Computer-Aided Software Engineering and knowledge about current CASE tools use in the industry.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	I. Jacobson, M. Christerson, P. Jonsson, G. Overgaard, "Object Oriented Software Engineering", 2 nd Edition, Pearson Education. 2007

9. Objective : To introduce fundamentals of computer vision so that students will understand to program a computer for understanding a scene or features in an image development.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Radiometry –Measuring Light, light and surfacesRepresentation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading.	8
2.	2D/3D Vision:Filters, Binary Images, Features, Edge Detection, Texture, Shape, Segmentation, Clustering, Model Fitting, Probabilistic, 3D Vision:Multiview geometry, Stereo,Shape from X,3D data	6
3.	Image Processing and Feature Extraction: Image representations (continuous and discrete), Linear Filters, Texture, Edge detection.	6
4.	Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.	6
5.	Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis.	8
6.	Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition	8
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers.	6
2.	Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule.	6
3.	Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reconfigurable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioral Synthesis, RTL synthesis.	6
4.	Placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays.	6
5.	Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability.	8
6.	Overview of VHDL.	10
TOTAL		42

6. Semester : VII
7. Subject Area : DEC
8. Pre-requisite : Computer Networks
9. Objective : To understand the concept of wireless communication, mobile computing paradigm, its novel applications and limitations.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR, VLR, hierarchical, handoffs, channel allocation in cellular systems, Cellular telephone, Digital Cellular Standards, Call Routing in GSM, Satellite Technology, FDMA, TDMA, CDMA and GPRS.	5
2.	Wireless Networking, Wireless LAN Overview: MAC issues, PCF, DCF , Frame types, addressing, IEEE 802.11 standards, Blue Tooth: Architecture , Layers and protocols, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications, WAP application environment(WAE), WML, WSP, WTP and WTLS	9
3.	Data management issues, data replication for mobile computers, Replication through data allocation, User profile replication scheme, optimistic replication and active replication, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	6
4.	Mobile Agents computing: Introduction, Advantages, Application Domains; security and fault tolerance: Protecting server, code signalling, Firewall approach; security techniques and algorithms: DES, 3DES, AES, Diffie-Hellman, RSA ; transaction processing in mobile computing environment: Structure, properties, Data consistency, Transaction relation, Recovery and wireless data Dissemination.	9

8. Pre-requisite : Nil
9. Objective : To understand software testing concepts and applications..

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introductory concepts: Verification & Validation Terminologies like Goals, Role, Objectives, Limitations, Approaches & Applicability.	4
2.	Software Testing: Testing Process, Limitations of Testing, Testing activities. Levels of Testing: Unit Testing, Integration Testing, System Testing, Debugging, Domain Testing, Regression Testing, Stress Testing, Slice based testing.	8
3.	Verification Testing: Verification Methods, SRS Verification, Software Design Document Verification, Code Reviews, User Documentation Verification, Software Project Audits. Functional Testing techniques: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.	8
4.	Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing. Object Oriented Testing: Class Testing, GUI Testing.	8
5.	Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging Software Testing Tools Taxonomy: Methodology to evaluate automated testing. Using tools: Load Runner, Win runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT Cactus and other recent tools.	8
6.	Advanced Topics on Testing: Prioritizing the Test-cases, Testing Web Applications, Automated Test Data Generation.	6
TOTAL		42

2.	Introduction to Computational Science and Engineering Applications, their characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies which are drawn from multiscale, multidiscipline applications .	8
3.	Memory Hierarchies, Multi core Processors, Homogeneous and Heterogeneous, Sharedmemory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purposebuilt.	6
4.	Discussion about Parallel algorithms with Parallel models including ideal and real frameworks, Basic Techniques including Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel PseudoRandom Number Generators, Sorting, Monte Carlo techniques.	7
5.	Parallel Programming involving Revealing concurrency in applications ,Task and Functional parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, StarP, Matlab MPI) Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays).	8
6.	Discussion about high performance methods with Achieving Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, Using existing libraries, tools, and frameworks	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, AddisonWelsey, 2003.

2.	Programming; Programming Models and Paradigms, features and performance of standard MPI variants, Derived data types, communicators.	8
3.	Resource management and scheduling Managing, cluster resources: single system images, system level middleware, distributed task scheduling, monitoring and administering system resources Parallel I/O and Parallel Virtual File System. Scheduling: Condor, Maui Scheduler, Portable Batch System (PBS).	7
4.	Grid Computing: Grids and Grid Technologies, Programming models and Parallelization Techniques, Grid Security Infrastructure, Setting up Grid, deployment of Grid software and tools, and application execution.	9
5.	Standard application development tools and paradigms Performance evaluation tools, HINT, netperf, netpipe, tcp, lperf.message	8
6.	Data Management Application Case Study: Molecular Modeling for Drug Design and Brain Activity Analysis, Resource management and scheduling.	4
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Grid and Cluster Computing by C.S.R. Prabhu, PHI, 2008
2.	Introduction to grid computing - Bart Jacob, Michael Brown, 2005
3.	B. Wilkinson, Grid Computing: Techniques and Applications, CRC Press. 2009
Reference Books	
1.	R. Buyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education. 2008
2.	D. Janakiram, Grid Computing, Tata McGraw-Hill. 2005

4.	Hybrid Methods and Multi-objective Evolutionary Algorithms Variants of Particle Swarm optimization and Genetic Algorithm, Hybridization of Particle Swarm and Genetic based optimizations, Hybrid Multi-objective Optimization algorithms	6
5.	Recent nature-inspired evolutionary algorithms Cockoo search algorithm, Artificial Bee Colony Optimization, Ant Colony Optimization, Fire-fly algorithm, Bacterial Foraging, Application to the travelling salesman problem	6
6.	Application to real world optimization problems Optimization examples from Machine Learning, Robotics, Image Processing and Computer Vision, Web and data mining, network traffic routing	6
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1	“ Computational Intelligence”, Second Edition, by Andries P. Engelbrech, John Wiley & Sons, ISBN: 978-0-470-03561-0, 2008
2	“An Introduction to Genetic Algorithm”, Melanie Mitchell, MIT Press, 1996
3	“Genetic Algorithms in Search, Optimization, and Machine Learning”, David Goldberg. Addison-Wesley, 1989
4	“Introduction to Evolutionary Computing”, A.E Eiben and J.E. Smith, Springer, second edition, 2007
Reference Books	
1	“Evolutionary Computation”, D. Dumitrescu et al. CRC Press, 2000
2	“Evolutionary Computation, A “Unified Approach”, K. DeJong. MIT Press, 2006
3	“Evolutionary algorithms in engineering applications”, Dasgupta, Dipankar, and Zbigniew Michalewicz, . Springer Science & Business Media, 2013

Comprehend the evolution, development and research in the area of Web.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Inter-Networking: Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, APRANET and Internet history of the World Web, Basic Internet Terminology, Net etiquette. Working of Internet: Packet switching technology, Internet Protocols: TCP/IP, Router. Internet Addressing Scheme: Machine Addressing (IP address), E-mail Address, Resource Addresses.	6
2.	Internet Applications: E-mail, file transfer (FTP), telnet, usenet, Internet chat, Web.	4
3.	Evolution of Web: Web 1.0: Hypertext & linking documents, HTTP, Client-Server, peer-to-peer; Web Browser (Lynx, Mosaic, Netscape, Internet Explorer, Firefox, and Safari, the mobile web); Impact: Opportunities & Challenges. Web 2.0: From 1.0 to 2.0; Framework; Technologies: Client-side & server-side; Web 2.0 development technologies; Examples: social networking sites, blogs, wikis, video sharing sites, hosted services(web services, location-based services), web applications, mashups & folksonomies; Practical Usage. Web 3.0: From 2.0 to 3.0; Semantic Web: What, How, Why; From Web 3.0 to Web 4.0	10
4.	Web Development: Phases; Web Page, Website, and Web Application: Example, Technology Framework for development.cClient-side technology: HTML (HTML 5).Client-side scripting: JavaScript. Server-side technology: PHP.Server-side scripting: Server-side JavaScript.Web application development frameworks: Django& Ruby on Rails. Web Database: Database Connectivity: JDBC, ODBC; Database-to-web connectivity.	14
6.	Web Search and Mining: Web IR System: Search Engines, Web Crawling, Search Engine Optimization, Web Analytics, Web Mining Taxonomy; Web Mining Framework; Social Web Mining.Text Mining: Opinion Mining, Recommendation System, Topic Detection and Tracking.	8
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Introduction to parallel computing, need for parallel computing, parallel architectural classification schemes, Flynn's , Fang's classification, performance of parallel processors, distributed processing, processor and memory hierarchy, bus, cache & shared memory, introduction to super scalar architectures, quantitative evaluation of performance gain using memory, cache miss/hits.	6
2.	Multi-core Architectures: Introduction to multi-core architectures, issues involved into writing code for multi-core architectures, development of programs for these architectures, program optimizations techniques, building of some of these techniques in compilers, Open MP and other message passing libraries, threads, mutex etc.	6
3.	Multi-threaded Architectures Parallel computers, Instruction level parallelism (ILP) vs. thread level parallelism (TLP), Performance issues: Brief introduction to cache hierarchy and communication latency, Shared memory multiprocessors, General architectures and the problem of cache coherence, Synchronization primitives: Atomic primitives; locks: TTS, ticket, array; barriers: central and tree; performance implications in shared memory programs; Chip multiprocessors: Why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; Snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI; performance trade-offs; pipelined snoopy bus design; Memory consistency models: SC, PC, TSO, PSO, WO/WC, RC; Chip multiprocessor case studies: Intel Montecito and dual-core, Pentium4, IBM Power4, Sun Niagara	10
4.	Compiler Optimization Issues Introduction to optimization, overview of parallelization; Shared memory programming, introduction to Open MP; Dataflow analysis, pointer analysis, alias analysis; Data dependence analysis, solving data dependence equations (integer linear programming problem); Loop optimizations; Memory hierarchy issues in code optimization.	8

7. Subject Area : DEC
8. Pre-requisite : Nil
9. Objective : To familiarize the students with basic concepts in each type of IPR together with historical developments in the subject & its importance in modern times.
9. Objective : To familiarize the students with basic concepts in each type of IPR together with historical developments in the subject & its importance in modern times.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Concept of IPR, Historical development , kinds of IPR, brief description of patent, trademark, copyright ,industrial design, importance of IPR, IPR authorities.	5
2.	PATENTS :Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.	8
3.	Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration, licensing in trademark	7
4.	Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright, term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies	7
5.	Industrial design: The design act-2000, registerability of a design, procedure of registration of a design, piracy of a registered design, Case law on designs	6

9. Objective : To provide knowledge about the principles, concepts and applications of bioinformatics.

10. Details of Course

S.No.	Contents	Contact Hours
1.	The Biologist & Internet: Internet basics, FTP, World Wide Web, and Introduction to Primary & Secondary database, GenBank, GCG, and ACDEB. Structure Databases: Introduction to structures, PDB, MMDB, Structure file formats, Visualizing structural information, Database structure viewers, Introduction to the NCBI database, SeqIDS, Seq. Annot: Annotating the sequence, Seqdiscr: Describing the sequence.	10
2.	Information Retrieval from Biological Databases & submission of DNA Sequences to the Databases: Retrieving database entries, Integrated information retrieval: The ENTREZ system, sequence databases beyond NCBI, Medical Databases; Where to submit nucleotide sequences, How to submit on the World Wide Web, How to submit with sequin, Molecular modeling	8
3.	Sequence Alignment and Database Searching: Introduction, Evolutionary basis of sequence alignment, Optimal alignment methods, Substitution scores & gap penalties, Statistical significance of alignments, Database similarity searching, FASTA, BLAST, Low complexity regions, Repetitive elements.	8
4.	Multiple Sequence Alignment & Genome Mapping: Progressive alignment methods, Motifs and patterns, Probe, Presentation methods, Abscript; Different types of maps: physical, genetical, etc. Synteny, Human genome project, Application of genome mapping, Chromosome maps.	8
5.	Predictive Methods Using Nucleotide & protein Sequences: Framework, marking repetitive DNA, Database search, Codon bias detection, Detecting function sites in the DM, Protein identity based on composition.	8
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Software Quality Assurance Framework: What is Quality? Software Quality Assurance, Components of Software Quality Assurance, Software Quality Assurance Plan. Steps to develop and implement a Software Quality Assurance Plan.	7
2.	Quality Standards: ISO 9000 and Comparison ISO Standards, CMM, CMMI, PCMM, Malcolm Balridge, 3 Sigma, 6 Sigma, Software Quality Models.	8
3.	Measurement in Software Engineering: scope of software metrics, Basics of Measurement: Measuring External Product Attributes: Modeling Software Quality, Measuring aspects of quality, Framework for Software Measurement, Measuring Internal Product Attributes, Size and Structure: Aspects of Software Size, Length, Reuse, Functionality, Complexity, Types of Structural Measures, Modularity and information flow attributes.	8
4.	Software Quality Assurance Metrics and Measurement: Software Quality Metrics, Product Quality metrics, Process Quality Metrics, Metrics for Software Maintenance, Software Quality metrics methodology, Object Oriented Metrics in quality.	8
5.	Software Quality Estimation Tools: Desirable features in software Quality estimation tools, Study of some existing Tools for quality estimation.	7
6.	Computer Aided Quality Engineering (CAQE) Concepts, Design Techniques for CAQE.	4
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Software Metrics, Fenton, CRC press 2014

2.	MINING DATA STREAMS : 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.	8
3.	HADOOP: History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS-Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats-Map Reduce Features	10
4.	HADOOP ENVIRONMENT :Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud	8
5.	FRAMEWORKS: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications.	8
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2	Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
3	Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012

9. Objective : To study the concepts, architecture, models of a cloud and its security issues and service management parameters.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Overview of Computing Paradigm and introduction to cloud computing: Recent trends in Computing (Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing), Evolution of cloud computing(Business driver for adopting cloud computing), Cloud Computing (NIST Model) , Cloud service providers, Properties, Characteristics & Disadvantages, Cloud computing vs. Cluster computing vs. Grid computing,Role of Open Standards	8
2.	Cloud Computing Architecture: Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS) :Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Deployment Models(Public cloud, Private cloud, Hybrid cloud, Community cloud)	6
3.	Infrastructure as a Service(IaaS):Introduction to IaaS ,IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM),Resource Virtualization(Server, Storage, Network), Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service),	6
4.	Platform as a Service(PaaS):Introduction to PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management (Computation, Storage) Examples: Google App Engine, Microsoft Azure, Salesforce.com Software as a Service(SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS,Case Study on SaaS	8
5.	Service Management in Cloud Computing: Service Level Agreements(SLAs) (Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud , Economics of scaling: Benefitting enormously, Managing Data, Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing	8

9. Objective : The goal of natural language processing (NLP) is to design and build computer systems that are able to analyze natural languages like German or English, and that generate their outputs in a natural language.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: The study of Language, Introduction to NLP, Regular Expression, Finite State Automata, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Linguistic Background.	6
2.	Grammars and Parsing: Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.	7
3.	Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars, Hold mechanisms in ATNs, Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.	6
4.	Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Dependency Parsing, Best First Parsing, Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.	7
5.	Advanced Features and Syntax, Features and Unification: Feature structures – Unification of feature structures – Features structures in the grammar – Implementing unification – Parsing with unification constraints – Types and Inheritance. Lexicalized and Probabilistic Parsing: Probabilistic context-free grammar – problems with PCFGs – Probabilistic lexicalized CFGs – Dependency Grammars – Human parsing.	8

8. Pre-requisite : NIL
9. Objective : To introduce various techniques related to cyber forensics.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction : Review of TCP/IP and TCP, IP Header analysis , Introduction to Cyber World, Cyber attacks and cyber security , Information warfare and cyber terrorism, Types of cyber attacks, Cyber Crime and Digital Fraud , Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations)	10
2.	Live Data collection and investigating windows environment : windows Registry analysis , Gathering Tools to create a response toolkit (Built in tools like netstat , cmd.exe , nbtstat , arp , md5sum, regdmpetc and tools available as freeware like Fport , Pslistetc), Obtaining volatile Data (tools like coffee , Helix can be used) Computer forensics in windows environment, Log analysis and event viewer, File auditing, identifying rogue machines, hidden files and unauthorized access points	12
3.	Live Data collection and investigating Unix/Linux environment : / Proc file system overview , Gathering Tools to create a response toolkit (Built in tools like losetup , Vnode , netstat , df , md5sum , straceetc and tools available as freeware like Encase , Carboniteetc) Handling Investigations in Unix/Linux Environment: Log Analysis (Network, host, user logging details), Recording incident time/date stamps, Identifying rogue processes, unauthorized access points, unauthorized user/group accounts	10
4.	Forensic tools and report generation: Recovery of Deleted files in windows and Unix, Analyzing network traffic, sniffers, Ethical Hacking, Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), Mobile forensic tools and analysis of called data record Template for computer forensic reports	10
TOTAL		42

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: The Semantic Web Roadmap, evolution of Web Documents, Semantic Search Techniques.	10
2.	XML Languages: Detailed study of XML language & application to Web based developments.	10
3.	Describing Web Resources: Resource Description Framework (RDF), Taxonomies, Ontologies, Web Ontology Language (OWL), Design process of ontology, Annotation.	12
4.	Advanced Topics: Semantic Applications & Power, Latest on Semantic Web, Future Directions, W3C Consortium, Case studies in different application.	10
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books:	
1	"A Semantic Web Primer", Grigoris Antoniou and Frank van Harmelen, MIT Press.
2	"Spinning the Semantic Web - Bringing the World Wide Web to Its Full Potential", MIT Press, Dieter Fensel, James A. Hendler, Henry Lieberman, and Wolfgang Wahlster (Eds.)
3	"The Semantic Web: A guide to the future of XML, Web Services and Knowledge Management", Michael C. Daconta, Leo J. Obrst Kevin T. Smith, Wiley Publishing.
Reference Book:	
1	"Principles of Semantic Networks: Explorations in the representation of knowledge", John Sowa. Morgan Kaufmann.
2	Russell and Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall.
3	Han Reichgelt, "Knowledge Representation: An AI Perspective", Ablex Publishing.

5.	Software Project Management Renaissance: Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.	6
6.	Advance Topics in Software Project Management: Discussion on future Software Project Management Practices & Modern Project Profiles, Next Generation Software Economics, Modern Process Transitions.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers/ Year of Publication/ Reprint
Text Books	
1.	Managing the Software Process, Watts S. Humphrey, Pearson Education. 1989
2.	Software Project Management, Bob Hughes, Tata McGraw Hill. 2009
Reference Books	
1.	Sommerville, "Software Engineering", Addison Wesley. 2001

OPEN ELECTIVE COURSES

CO351 ENTERPRISE & JAVA PROGRAMMING

1. Subject Code: **CO351** Course Title: **Enterprise & Java programming**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : To introduce fundamentals of Enterprise Java Programming, concepts of program development using beans.
10. Details of Course :

Unit No.	Contents	Contact Hours
1.	Collections : Collection Interfaces, Concrete Collections, Collections Framework. Multithreading : Creating and running thread, Multiple thread synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.	5

2.	<p>Fundamentals in Networking: Sockets in Java - Internet Addressing - DNS – Ipv4,Ipv6- URL class - TCP/IP and Datagram. The interfaces and classes for networking :Interfaces and classes of java.net package; InetAddress class : IP address scope - Host name resolution - Methods of InetAddress class; Program to look up the IP addresses for a hostname - Factory methods - Creating and using Sockets : Socket class - constructors and methods of Socket class. Creating TCP servers & clients : TCP/IP server sockets - Constructors and methods of ServerSocket class - Program to create a TCP/IP server and client. Handling URL: URL class - constructors and methods of URL class -URLConnection class - fields of URLConnection class - methods of URLConnection class. Working with Datagrams: DatagramPacket - Constructors for DatagramPacket class - Methods of DatagramPacket class - creating Datagram server and client.</p>	6
3.	<p>JDBC Package :JDBC – JDBC versus ODBC – Types of JDBC drivers – Connection – Statement – PreparedStatement.ResultSet :Fields of ResultSet – Methods of ResultSet – Executing a query - ResultSetMetaData – DatabaseMetaData. Datatypes in JDBC : Basic datatypes in JDBC – Advanced datatypes in JDBC – fields of Statement – methods of Statement – CallableStatement Interface – BatchUpdates</p>	6
4.	<p>Servlets : Using Servlets - Servlet Package - Servlet lifecycle - init() method - service() method , doGet() method, doPost() method and destroy() method . Classes and interfaces of Servlet: Servlet - GenericServlet - ServletConfig - ServletContext - ServletException - ServletInputStream - ServletOutputStream - ServletRequest – ServletResponse. Classes and interfaces of HttpServlet: HttpServlet - HttpServletRequest - HttpServletResponse - Reading HTML form data from Servlets - Response Headers - Response Redirection. Handling Servlets : Servlet Chaining - HttpUtils - Database access with JDBC inside servlet. State and Session management : Cookies - HttpSession - Server Side includes - Request forwarding – RequestDispatcher.</p>	7

5.	Concepts of Java Beans: Java Beans - Advantage of Java Beans - Reflection and Introspection - Customizers – Persistence. Developing Java Beans : Bean Developer Kit (BDK) - Creating a Java Bean - Creating a Bean Manifest file - Creating a Bean JAR file. Controls and Properties of a Bean : Adding controls to Beans - Giving Bean Properties - BeanInfo interface - SimpleBeanInfo class. Types of Properties: Design pattern for Properties: Simple properties - Indexed Properties; Descriptor Classes - Giving Bean methods - Bound and Constrained Properties - Property Editors.	9
6.	Components of EnterpriseBeans : Distributed Multitiered Applications -J2EE components: J2EE clients, Web components, J2EE containers. Developing an Enterprise Bean : Packaging - Enterprise JavaBeans Technology - Enterprise Bean - Contents of an Enterprise Bean. Session Bean : Stateful session bean – life cycle of stateful session bean - Stateless session bean – life cycle of stateless session – ejbCreate methods – Business methods – Home interface – Remote interface – Running the session bean. Entity Bean :Persistence - Bean managed Persistence - Container Managed Persistence - Shared Access - Primary key – Relationships. Message Driven Bean :life cycle of message driven bean – onMessage method.	9
Total		42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers
Text Books	
1.	Java 2 Programming Black Book - Steven Holzner dreamTech Press(ISBN-9788177226553), 2005
2.	JavaBeans Programming from the GroundUp - Joseph O'Neil, TMGH, New Delhi(ISBN- 007463786X), 2001
Reference Books	

3.	Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.	6
4.	Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.	6
5.	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, The Evolution of ERP, The Structure of ERP. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing(OLAP), Product Life Cycle Management(PLM), LAP, Supply chain Management.	8
6.	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, The Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees, ERP & E-Commerce, Future Directives- in ERP, ERP and Internet.	8
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Goel, Ritendra "E-commerce", New Age International, 2007
2.	Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison-Wesley. 1996
3.	Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI 2004
4.	Rahul V. Altekar "Enterprise Resource Planning", Tata McGraw Hill, 2004
5.	Alexis Leon, "ERP Demystified", Tata McGraw Hill, 2014

CO355 CRYPTOGRAPHY AND INFORMATION SECURITY

1. Subject Code: **CO355** Course Title: **Cryptography and Information Security**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To study various cryptographic techniques, mathematics related to cryptography and some network security protocols.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction: Need for security, Introduction to security attacks, services and mechanism, introduction to cryptography, Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers, Intruders, Viruses and related threads.	6
2.	Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, Fiestal structure, data encryption standard(DES), strength of DES, crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, key distribution.	6

3.	Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primarily testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms, Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption	8
4.	Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code (MAC), hash functions, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA), Public Key Infrastructure(PKI): Digital Certificate, private key management, Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.	6
5.	Authentication Applications: Kerberos and X.509, directory authentication service, password, challenge-response, biometric authentication, electronic mail security-pretty good privacy (PGP), S/ MIME.	8
6.	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money, WAP security, firewall design principals, Virtual Private Network (VPN) security.	8
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersey. 2016
2.	Atul Kahate, "Cryptography and Network Security", TMH. 2009
3.	Behrouz A. Forouzan, "Cryptography and Network Security", TMH.2007
4.	Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag. 2004
5.	Bruce Schneier, "Applied Cryptography". 2015

CO357 OPERATING SYSTEM

1. Subject Code: **CO357** Course Title: **Operating System**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiar with the fundamental principles of the operating system, its services and functionalities, the concepts of processes, synchronization and scheduling, memory management and need for protection in computer systems
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. Operating System Structure: System Components, System structure, Operating System Services.	4
2.	Concurrent Processes: Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling. CPU Scheduling: Scheduling Concept, Performance Criteria of Scheduling Algorithm, Evolution, Multiprocessor Scheduling.	9

3.	Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.	8
4.	Memory Management: Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replacement algorithms, Allocation of frames, Thrashing, Cache memory organization, Impact on performance.	9
5.	I/O Management & Disk Scheduling: I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues. File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues	9
6.	Case Studies: Windows, Linux and Unix	3
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books	
1.	Silberschatz and Galvin, “Operating System Concepts”, Pearson, 5th Ed, 2001
2.	Tannenbaum, “Operating Systems”, PHI, 4th Edition, 2000
Reference Books	
3.	Milenekovic, “Operating System Concepts”, McGraw Hill 2001
4.	Dietel, “An introduction to operating system”, Addison Wesley 1983

CO359 INTELLECTUAL PROPERTY RIGHTS

1. Subject Code : **CO359** Course Title: **Intellectual Property Rights**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0

5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : To familiarize the students with basic concepts in each type of IPR together with historical developments in the subject & its importance in modern times.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction: Concept of IPR, Historical development , kinds of IPR,brief description of patent, trademark, copyright ,industrial design, importance of IPR, IPR authorities.	5
2.	PATENTS :Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.	8
3.	Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration,licensing in trademark	7
4.	Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright,term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies	7

6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To provide knowledge about the principles, concepts and applications of Database Management System.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	<p>Introduction: Data base system concepts and its architecture, Data models schema and instances, Data independence and data base language and interface, Data definition languages, DML. Overall data base structure.</p> <p>Data modeling using Entity Relationship Model: E.R. model concept, notation for ER diagrams mapping constraints, Keys, Concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model.</p>	7
2.	<p>Relational Data Model and Language: Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions, triggers, foreign key relational algebra, relational calculus, domain and tuple calculus, SQL data definition queries and updates in SQL.</p>	7
3.	<p>Data Base Design: Functional dependencies, normal forms, 1NF, 2NF, 3NF and BCNF, multi-valued dependencies fourth normal forms, join dependencies and fifth normal forms. Inclusion dependencies, loss less join decompositions, normalization using FD, MVD and JDs, alternatives approaches to database design.</p>	6
4.	<p>File Organization, Indexing and Hashing Overview of file organization techniques, Indexing and Hashing-Basic concepts, Static Hashing, Dynamic Hashing, Ordered indices, Multi-level indexes, B-Tree index files, B+- Tree index files, Buffer management</p> <p>Transaction processing concepts: Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recovery from transaction failures, deadlock handling.</p>	8

5.	Concurrency Control Techniques: Locking Techniques for concurrency control, time stamping protocols for concurrency control, concurrency control in distributed systems. multiple granularities and multi-version schemes.	8
6	Case Studies: Commercial databases, Oracle, Postgress, MySQL	6
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books	
1	Elmasri, Navathe, "Fundamentals of Database systems", Addison Wesley, 2016
2	Korth, Silberchatz, Sudarshan, "Data base concepts", McGraw-Hill. 2010
Reference Books	
1	Ramakrishna, Gehkre, "Database Management System", McGraw-Hill 2014
2	Date C.J., "An Introduction to Database systems" 2006

EC351 MECHATRONICS

- | | |
|--------------------------------------|---|
| 1. Subject Code: EC351 | Course Title: Mechatronics |
| 2. Contact Hours | : L: 3 T: 0 P: 0 |
| 3. Examination Duration (ETE) (Hrs.) | : Theory 3 Hrs Practical 0 |
| 4. Relative Weightage | : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0 |
| 5. Credits | : 3 |
| 6. Semester | : V |
| 7. Subject Area | : OEC |
| 8. Pre-requisite | : Nil |
| 9. Objective | : To introduce fundamentals of Mechatronics |

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction : Basic Definitions and key elements of Mechatronics, Mechatronic Design Approach: Functions of Mechatronic Systems, Ways of Integration, Information Processing Systems (Basic Architecture and hardware and Software trade-offs, Concurrent Design Procedure for Mechatronic Systems	6
2.	System Interfacing, Instrumentation, and Control Systems: Input and output Signals of a Mechatronic System, Signal Conditioning and microprocessor control, Microprocessor-Based Controllers and Microelectronics, Programmable Logic Controllers	6
3.	Introduction to Micro- and Nanotechnology, Micro-actuators, Micro-sensors, Nanomachines. Modeling Electromechanical Systems: Models for Electromechanical Systems, Rigid Body Models, Basic Equations of Dynamics of Rigid Bodies, Simple Dynamic Models, Elastic System Modeling, Dynamic Principles for Electric and Magnetic Circuits, Earnshaw's Theorem and Electromechanical Stability	10
4.	The Physical Basis of Analogies in Physical System Models: The Force-Current Analogy: Across and Through Variables, Maxwell's Force-Voltage Analogy: Effort and Flow Variables, A Thermodynamic Basis for Analogies	6
5.	Introduction to Sensors and Actuators: Characteristics of Sensor and Actuator Time and Frequency Measurement, The Role of Controls in modelling in Mechatronics: Integrated Modeling, Design, and Control Implementation, Special Requirements of Mechatronics that Differentiate from Classic Systems and Control Design, Modeling as Part of the Design Process, Modeling of Systems and Signals	6
6.	Design Optimization of Mechatronic Systems: Optimization Methods, Principles of Optimization : Parametric Optimization, General Aspects of the Optimization Process, Types of Optimization Methods, Selection of a Suitable Optimization Method, Optimum Design of Induction Motor (IM), IM Design Introduction : Classical IM Design, Use of a Neuron Network for the Identification of the Parameters of a Mechanical dynamic system, Mechatronics and Computer Modeling and Simulation, Mechatronics and the Real-Time use of Computers, Communications and Computer Networks, Control with Embedded Computers and Programmable Logic Controllers	8
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Mechatronics : an introduction by Robert H Bishop, Taylor & Francis, 2005
2	Introduction to Mechatronics by KK AppuKuttan Oxford University Press, 2007

EC353 COMPUTER VISION

1. Subject Code : **EC-353** Course Title: **Computer Vision**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS - MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : To introduce fundamentals of Computer Vision and algorithms for object detection, recognition and tracking.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction to computer vision: Role of Artificial intelligence and image processing in Computer Vision, Industrial Machine Vision applications, System architecture. Visual Sensors: Camera sensors: RGB, IR, Kinect sensor, Camera interfaces and video standards, Characteristics of camera sensors commercially available cameras. Camera Calibration: Interior, exterior calibration and rectification using Tsai's Calibration method.	5

2.	Basics of image processing – Pixel representations histograms ,transforms, colour filters, noise removal, Geometry: Math methods -linear algebra, vectors, rotations, Stereo – Epi-polar geometry, correspondence, triangulation ,Disparity maps . Basics of video processing – Background subtraction techniques – frame differencing, Gaussian Mixture Modelling (GMM), Object localization and processing:- Contours, edges, lines, skeletons.	7
3.	Image representation: Local Wavelet basis (multiscale), Global Fourier basis(Frequency), Adaptive basis (PCA and ICA) , Adaptive basis(discriminants) Basics of Object detection – Template matching, Cascade classifiers.	8
4.	Object Recognition : Object Modeling, Bayesian Classification, Feature Selection and Boosting, Scene and Object Discrimination.	6
5.	Motion and Tracking: Motion detection and tracking of point features, optical flow, SURF, SIFT. Tracking- Kalman filter, Particle Filter, Comparison of deterministic and probabilistic methods condensation, tracking humans, multi-frame reconstruction under affine and perspective projection geometry.	8
6.	Introduction to Computer Vision programming libraries: MATLAB/ OpenCV. advantages and disadvantages of each .	8
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Computer Vision: A Modern Approach (2nd Edition) 2nd Edition by David A. Forsyth (Author), Jean Ponce (Author), 2002
2.	Learning OpenCV: Computer Vision with the OpenCVLibrary Gary Bradski, Adrian Kaehler, 2008

EC355 EMBEDDED SYSTEM

1. Subject Code: **EC- 355** Course Title: **Embedded Systems**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Knowledge of Computer Architecture and Microprocessors
9. Objective : To introduce fundamentals of 16 and 32 bit Microcontrollers, assembly language programming. The course also focuses on interfacing of different interrupt driven peripherals. It also covers in detail Real Time Operating Systems, Bus architecture, Digital Signal Processors and System On-Chip.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Overview of Embedded Systems: Characteristics of Embedded Systems. Comparison of Embedded Systems with general purpose processors. General architecture and functioning of micro controllers. PIC and 8051 micro controllers : Architecture, memory interfacing , interrupts, instructions, programming and peripherals .	8
2.	ARM : Architecture, memory interfacing , interrupts, instructions and Assembly Language programming. Exception processing and pipeline architecture and applications.	12

3.	Digital Signal Processors: DSP Architecture, DSP applications, algorithms, data path, memory, addressing modes, peripherals. TI and Sharc family of DSP processors.	4
4.	System On Chip : Evolution, features, IP based design, TI OMAP architecture and peripherals. Digital Multimedia processor: Architecture and peripherals.	4
5.	SRAM, DRAM working and organization. Interfacing memory with ARM 7. Elements of Network Embedded Systems	4
6.	RTOS : RT-Linux introduction, RTOS kernel, Real-Time Scheduling Bus structure: Time multiplexing, serial, parallel communication bus structure. Bus arbitration, DMA, PCI, AMBA, I2C and SPI Buses.	10
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Computers as components: Principles of Embedded Computing System Design, Wayne Wolf, Morgan Kaufman Publication, 2000
2.	ARM System Developer's Guide: Designing and Optimizing System Software, Andrew N. Sloss, Dominic Symes, Chris Wright, , Morgan Kaufman Publication, 2004
3.	Design with PIC Microcontrollers, John B. Peatman, Pearson Education Asia, 2002
4.	The Design of Small-Scale embedded systems, Tim Wilmshurst, Palgrav, 2003
5.	Embedded System Design, Marwedel, Peter, Kluwer Publishers, 2004

EC357 DIGITAL IMAGE PROCESSING

- | | |
|--------------------------------------|---|
| 1. Subject Code: EC 357 | Course Title: Digital Image Processing |
| 2. Contact Hours | : L: 3 T: 0 P: 0 |
| 3. Examination Duration (ETE) (Hrs.) | : Theory 3Hrs Practical 0 |
| 4. Relative Weightage | : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0 |
| 5. Credits | : 3 |

6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Signals and Systems
9. Objective : To introduce the fundamentals of visual information, representation of 2-D and 3-D information, enhancement of information, retrieval of information, and various colour models.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction to Image processing, fundamental steps in DIP, concept of visual information, image formation model, image sampling and quantization, digital image representation, spatial and gray level resolution, relationship between pixels, application of image processing system.	6
2.	Introduction to Multidimensional signals and systems, 2D-Signals, 2D systems, classification of 2D system, 2D convolution, 2D Z-transform, Image Transform: 2D-DFT, discrete cosine, discrete sine, Haar, Walsh, Hadamard, Slant, KL, SVD, Hough, Radon, Ridgelet.	8
3.	Image enhancement; Spatial domain: linear transformation, image negative, grey level shifting, non-linear transformation, logarithmic transformation, exponential transformation, grey level slicing, bit plane slicing, image averaging, mask processing, histogram manipulations, histogram thresholding, histogram stretching, histogram equalization, noise removing filters, smoothing filters, sharpening filters. Enhancement in Frequency Domain; ideal low pas filter, Butterworth low pass filter, ideal high pass filters, Butterworth high pass filter, band pass filter, Gaussian filters, Homomorphic filtering.	10
4.	Image restoration: degradation model, noise models, restoration in presence of noise, periodic noise removal in frequency domain, notch filters, inverse filtering, Wiener filtering.	6

5.	Introduction to Morphological Image Processing operations, dilation and erosion, opening and closing, hit-or-miss transformation, boundary extraction, region filling, extraction connected components, convex hull, thinning, thickening, skeletons, pruning.	6
6.	Introduction to various colour models: RGB, CMY, CMYK, HSI, HSV, and YCbCr. Concept of image compression, Image Segmentation: detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation, use of motion in segmentation.	6
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Digital Image Processing/ Gonzalez and Woods/ Pearson Education, 2008/Third Edition
2.	Fundamentals of Digital Image Processing/ A.K. Jain/ PHI, Indian Edition
3.	Digital Image Processing using MATLAB/ Gonzalez, Woods, and Eddins/ McGraw Hill, Second/ 2013
4.	Digital Image Processing/ K.R. Castleman/ Pearson, 2014
5.	Digital Image Processing Algorithms and Applications/I. Pitas/John Wiley, 2002
6.	Image Processing, Analysis, and Machine Vision/Milan Sonka, Vaclav Hlavac, Roger Boyale/ Cengage Learning, 4 th Edition

EC359 VLSI DESIGN

1. Subject Code: **EC -359** Course Title: **VLSI Design**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V

7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : To give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction to VLSI, Manufacturing process of CMOS integrated circuits, CMOS n-well process design rules, packaging integrated circuits, trends in process technology. MOS transistor, Energy band diagram of MOS system, MOS under external bias, derivation of threshold voltage equation, secondary effects in MOSFETS	6
2.	MOSFET scaling and small geometry effects, MOS capacitances, Modeling of MOS transistors using SPICE, level I II and equations, capacitance models. The Wire: Interconnect parameters: capacitance, resistance and inductance. Electrical wire models: The ideal wire, the lumped model, the lumped RC model, the distributed RC model, the transmission line model, SPICE wire models.	6
3.	MOS inverters: Resistive load inverter, inverter with n-type MOSFET load, CMOS inverter: Switching Threshold, Noise Margin, Dynamic behavior of CMOS inverter, computing capacitances, propagation delay, Dynamic power consumption, static power consumption, energy, and energy delay product calculations, stick diagram, IC layout design and tools.	8

4.	Designing Combinational Logic Gates in MOS and CMOS: MOS logic circuits with depletion MOS load. Static CMOS Design: Complementary CMOS, Ratioedlogic, Pass transistor logic, BiCMOS logic, pseudo nMOS logic, Dynamic CMOS logic, clocked CMOS logic CMOS domino logic, NP domino logic, speed and power dissipation of Dynamic logic, cascading dynamic gates.	8
5.	Designing sequential logic circuits: Timing matrices for sequential circuits, classification of memory elements, static latches and registers, the bistability principle, multiplexer based latches , Master slave Edge triggered register , static SR flip flops, dynamic latches and registers, dynamic transmission gate edge triggered register, the C2MOS register	8
6.	Pulse registers, sense amplifier based registers, Pipelining, Latch verses Register based pipelines, NORA-CMOS. Two-phase logic structure; VLSI designing methodology –Introduction, VLSI designs flow, Computer aided design technology: Design capture and verification tools, Design Hierarchy Concept of regularity, Modularity & Locality, VLSI design style, Design quality.	6
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Digital integrated circuits a design perspective byJan M Rabaey, Anantha Chadrakan Borivoje Nikolic, Pearson education, 2011.
2.	CMOS digital integrated circuits by Sung MO KangYusuf Leblebici, Tata McGraw Hill Publication, 2002
3.	Principle of CMOS VLSI Design by Neil E Weste and Kamran Eshraghian, Pearson education, 2000.

EE351 POWER ELECTRONIC SYSTEMS

1. Subject Code: **EE-351** Course Title: **Power Electronic Systems**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0

4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with power electronics and its applications.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Solid State Power Devices: Principle of operation of SCR, dynamic characteristic of SCR during turn ON and turn OFF, parameters of SCR, dv/dt and di/dt protection, snubber circuit, commutation circuits; Principle of operation of MOSFET, IGBT, GTO, MCT, SIT, SITH, IGCT, their operating characteristics.	8
2.	Single-phase Converter: Half wave converter, 2-pulse midpoint converter, half controlled and fully controlled bridge converters, input current and output voltage waveforms, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage, effect of free-wheeling diode, triggering circuits. Three-phase Converter: Half wave, full wave, half controlled and fully controlled bridge converters, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage,	8
3.	AC-AC Converters: Principle of operation of cycloconverter, waveforms, control technique; Introduction of matrix converter.	4
4.	DC-DC Converters: Principle of operation of single quadrant chopper, continuous and discontinuous modes of operation; Voltage and current commutation, design of commutating components; Introduction to SMPS.	4

5.	Inverters: Voltage source and current source inverters, Principle of operation of single-phase half bridge and full bridge voltage source inverters, voltage and current waveforms; Three-phase bridge inverter, 120° and 180° modes of operation, voltage and current waveforms with star and delta connected RL load; Voltage and frequency control of inverters; PWM techniques-single pulse, multiple pulse, selective harmonic elimination, sinusoidal PWM.	8
6.	Applications: FACTS Technology: Reactive power control in power systems, transmission system compensation, static series and shunt compensation, static shunt and series compensators- SVC, STATCOM, TCSC, SSSC and their working principles and characteristics. Combined series-shunt compensators –UPFC and its applications and characteristic. VSC-HVDC Systems: Principles and applications	10
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	Mohan N., Undeland T. M. and Robbins W. P., "Power Electronics-Converters, Applications and Design", 3 rd Ed., Wiley India, 2002.
2.	Rashid M. H., "Power Electronics Circuits Devices and Applications", 3 rd Ed., Pearson Education, 2004.
3.	N.G. Hingorani and L. Gyugyi, "Understanding FACTS", IEEE Press, 2000
4.	K.R. Padiyar, "Facts Controllers In Power Transmission and Distribution", New Age publishers, 2013
5.	HVDC power transmission system, K.R.Padiyar, NewAge Publishers,2011

EE353 ELECTRICAL MACHINES AND POWER SYSTEMS

- | | |
|--------------------------------|---|
| 1. Subject Code: EE-353 | Course Title: Electrical Machines and Power Systems |
| 2. Contact Hours | : L: 3 T: 0 P: 0 |
| 3. Examination Duration (Hrs.) | : Theory: 3 Practical: 0 |

4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with electrical machines and power systems.
10. Details of Course:

Unit No.	Contents	Contact Hours
1	Transformers : constructional features, types, Special constructional features – cruciform and multiple stepped cores, cooling methodology, conservators, breather, Buchholz relay, voltage, current and impedance relationships, equivalent circuits and phasor diagrams at no load and full load conditions, voltage regulation, losses and efficiency, all day efficiency, auto transformer and equivalent circuit, parallel operation and load sharing.	8
2	Asynchronous machines: General constructional features of poly phase asynchronous motors, concept of rotating magnetic field, principle of operation, phasor diagram, Equivalent circuit, torque and power equations, torque-slip characteristics, losses and efficiency.	8
3	Synchronous machines : General constructional features, armature winding, emf equation, effect of distribution and pitch factor, flux and mmf relationship, phasor diagram, non-salient pole machine, equivalent circuit, determination of equivalent circuit parameters by open and short circuit tests, voltage regulation using synchronous impedance method, power angle characteristics	9
4	Single line diagram of power system, brief description of power system elements, synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator. Supply System: different kinds of supply system and their comparison, choice of transmission voltage. Transmission Lines: configurations, types of conductors, resistance of line, skin effect	9

5	Transmission lines: Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit ,transmission lines, representation and performance of short, medium and long transmission lines, Ferranti effect,surge impedance loading.	8
Total		42

11. Suggested Books

S. No.	Name of Authors /Books / Publishers
1	Fitzgerald. A.E., Charles KingselyJr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 2006.
2	M.G. Say, 'Performance and Design of Alternating Current Machines', CBS Publishers, New Delhi, 2008
3	Nagrath I. J and Kothari D.P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2010.
4	Power System Analysis, J. Grainger and W.D. Stevenson, TMH, 2006.
5	Electrical Power Systems,C. L.Wadhwa, New age international Ltd. Third Edition, 2010
6	Electric Power Generation, Transmission&Distribution,S.N.Singh, PHI Learning, 2008.

EE-355 INSTRUMENTATION SYSTEMS

1. Subject Code: **EE-355** Course Title: **Instrumentation Systems**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC

8. Pre-requisite : NIL
9. Objective : To familiarize the students with instrumentation systems.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Transducers-I:Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, strain gauges, resistance thermometer, thermistors, thermocouples, LVDT, RVDT	8
2	Transducers-II:Capacitive, piezoelectric, Hall effect and opto electronic transducers. measurement of motion, force, pressure, temperature flow and liquid level.	8
3	Telemetry:General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data Acquisition System:A/D and D/A converters, analog data acquisition system, digital data acquisition system, modern digital data acquisition system and signal conditioning.	8
4	Display Devices and RecordersDisplay devices, storage oscilloscope, DSO, spectrum analyzer, digital recorders. RecentDevelopments:Introduction to virtual and intelligent instrumentation, fibre optic transducers, smart sensors, smart transmitters, process instrumentation diagrams.	8
5	Programmable Logic Controllers :Evolution of PLC-sequential and programmable controllers, architecture and programming of PLC, relay logic and ladder logic, functional blocks, communication networks for PLC, field bus, profi-bus, mod-bus	10
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Electronic Instrumentation and Measurement Techniques, W.D. Cooper and A.D. Helfrick, Prentice Hall International, 2009.
2	Measurement Systems Application and Design Ernest Doebelin, McGraw- Hill Higher Education, 5 th edition , 2003
3	Instrumentation, Measurement and Analysis, B.C. Nakra& K. Chaudhry, Tata McGraw Hill, 2 nd Edition, 2001.
4	Advanced Measurements and Instrumentation, A.K. Sawhney, DhanpatRai& Sons, 2010
5	Process Control Instrumentation Technology, Curtis D. Johnson, Pearson, 6 th edition, 1999
6	Programmable Logic Controllers, Frank D. Petruzella McGraw-Hill Higher Education, 4 th edition, 2010

EE357 UTILIZATION OF ELECTRICAL ENERGY

1. Subject Code: **EE-357** Course Title: **Utilization of Electrical Energy**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concept of electrical power, energy and its utilization.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Illumination: Definition:- Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux. Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light, Review of laws of illumination, Different types of lighting sources and their use in domestic, street and industrial lighting, Energy considerations. LED's and their driving circuits.	10
2	Electric Heating : Advantages of electrical heating, Heating methods: Resistance heating – direct and indirect resistance heating, properties of resistance heating elements, Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace, Dielectric heating, applications in various industrial fields, Infra-red heating and its applications, Microwave heating	08
3.	Electric Welding: Introduction to electric welding, Welding methods, Principles of resistance welding, types – spot, projection seam and butt welding and welding equipment used, Principle of arc production, electric arc welding, characteristics of arc, Design of Power supply and welding control circuit, comparison between AC and DC arc welding, welding control.	08
4.	Electrolytic Processes: Need of electro-deposition laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing equipment and accessories for electroplating factors affecting electro-deposition , principle of galvanizing and its applications, anodising and its applications, electroplating on non-conducting materials, manufacture of chemicals by electrolytic process, electrolysis for water purification	08
5.	Refrigeration and Air Conditioning and Water Coolers: Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants, description of electrical circuit used in a) refrigerator, b) air-conditioner, and c) water cooler, variable speed drive for compressors, high speed compressors, insta-chill, Peltier effect, thermoelectric cooling, sterling engines, solar concentrator heating and cooling,	08
Total		42

11. Suggested books:

S. No.	Name of Authors /Books / Publishers
1.	Dubey G. K., "Fundamentals of Electric Drives", 2 nd Ed., Narosa Publishing House,2007.
2.	Taylor E. O., "Utilization of Electric Energy (in SI units)", Orient Longman, Revised in S.I. units by Rao, V.V.L,1999
3.	Hancock N. N., "Electric Power Utilisation", Wheelers,1979.

EE-359 NON-CONVENTIONAL ENERGY SYSTEMS

1. Subject Code: **EE-359** Course Title: **Non-conventional Energy Systems**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the non-conventional sources of energy and their integration to the grid.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction to Non Conventional Energy Systems Various non-conventional energy resources Introduction, availability, classification, relative merits and demerits. Solar Cells: theory of solar cells, solar cell materials, solar cell array, solar cell power plant, limitations. Solar Thermal Energy: solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance, solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.	10
2	Geothermal Energy Resources of geothermal energy, thermodynamics of geothermal energy conversion, electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): principle of working of MHD power plant, performance and limitations.	8
3	Fuel Cells: Basic principle of working, various types of fuel cells, performance and limitations.	8
4	Thermo-electrical and thermionic conversions Principle of working of thermo-electrical and thermionic conversions, performance and limitations. Wind energy: wind power and its sources, site selection criteria, momentum theory, classification of rotors, concentrations and augments, wind characteristics, performance and limitations of wind energy conversion systems.	8
5	Energy from Bio-mass, Ocean Thermal, Wave and bio-waste Availability of bio-mass and its conversion principles, ocean thermal energy conversion principles, performance and limitations, wave and tidal energy conversion principles, performance and limitations, bio-waste recycling power plants.	8
Total		42

11. Suggested books:

S. No.	Name of Authors /Books / Publishers
1	Renewable Energy Resources, John Twidell, Tony Weir, Taylor and Francis, 2 nd edition, 2005.

2	Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley & Sons, 4 th edition, 2013.
3	Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks, D. Pimentel, Springer, 1 st edition, 2010.
4	Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Chetan Singh Solanki, PHI Learning, 2013.
5	Non Conventional Energy Resources, D.S. Chauhan, New Age International Pvt Ltd., 2006

EE-361 EMBEDDED SYSTEMS

1. Subject Code: **EE-361** Course Title: **Embedded Systems**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of embedded systems.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Embedded Processing – Evolution, Issues and Challenges;	1
2	System and Processor Architecture : von Neumann, Harvard and their variants	2

3	Memory Architecture and Devices; Input-Output Devices and Mechanisms	5
4	Instruction Set and Addressing Modes, Interfacing of Memory and Peripheral Devices – Functional and Timing Issues	6
5	Application Specific Logic Design using Field Programmable Devices and ASICs	2
6	Analog to Digital and Digital to Analog Converters	2
7	Bus I/O and Networking Considerations, Bus and Wireless Protocols	4
8	Embedded Systems Software : Constraints and Performance Targets	2
9	Real-time Operating Systems : Introduction, Scheduling in Real-time Operating Systems	4
10	Memory and I/O Management : Device Drivers	2
11	Embedded Software Development : Flow, Environments and Tools	2
12	System Specification and Modelling	2
13	Programming Paradigms	2
14	System Verification	2
15	Performance Analysis and Optimisation : Speed, Power and Area Optimisation, Testing of Embedded Systems	4
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	S. Heath, "Embedded Systems Design", Elsevier India,2005
2.	M. Ben-Ari, "Principles of Concurrent and Distributed Programming", Pearson,2005
3.	Jane Liu, "Real Time Systems", Pearson,2002

EN-351 ENVIRONMENTAL POLLUTION AND E –WASTE MANAGEMENT

1. Subject Code: **EN-351** Course Title: **Environmental Pollution & E- Waste Management**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.) : Theory: 3 Hrs. Practical: 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : The overall aims of the course are for students to acquire understanding of the new and emerging contaminants from various industrial processes and their transformation products. Studying emerging environmental issues related to newer methods of manufacture of industrial products.

10. Details of Course

Unit No.	Contents	Contact Hours
1	UNIT-I New and emerging pollutants and related transformation products, Effects & risks of emerging contaminants on ecosystems and humans, Persistent pollutants. Analytical methods for identifying emerging pollutants and the products of their transformation	9
2	UNIT-II Micro pollutants- Pesticides, Pharmaceutical - Veterinary and human drugs, personal care products, Surfactants and surfactant metabolites, Flame retardants, Industrial additives and agents. Emerging pollutants' toxicity, and their water-related characteristics (degradability, solubility, sorption...)	9

3	UNIT-III Emerging Issues - E-waste, Hazardous Waste, Nuclear Waste, Nano pollution, Thermal Pollution, pollutant emission and treatment	8
4	UNIT-IV Emerging pollutants' emergence and fate in surface and ground water, as well as mathematical modelling, Sustainable Development, Risk mitigation	8
5	UNIT-V Transformation Products of Emerging Contaminants in the Environment, Removal of emerging contaminants from water, soil and air, methods and preventive measures.	8
Total		42

Course Outcome:

1. Introduction to new and emerging contaminants and their transformation products.
2. Study of pollutants from manufacturing of goods.
3. Emerging area in environmental pollution.
4. Study of life cycle of a contaminant, modeling and mitigation.

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	G. Buttiglieri, T.P. Knepper, (2008), Removal of emerging contaminants in Wastewater Treatment: Conventional Activated sludge Treatment, Springer-Verlag Berlin Heidelberg, HdbEnvChem, vol. 5, Part S/2:1-35, DOI: 10.1007/698_5_098
2.	Alok Bhandari; Rao Y. Surampalli; Craig D. Adams; Pascale Champagne; Say Kee Ong; R. D. Tyagi; and Tian Zhang, Eds., (2009) Contaminants of Emerging Environmental Concern, American Society of Civil Engineers, ISBN (print): 978-0-7844-1014-1, ISBN (PDF): 978-0-7844-7266-8
3.	Dimitra A. Lambropoulou, Leo M. L. Nollet Eds. () Transformation Products of Emerging Contaminants in the Environment: Analysis, Processes, Occurrence, Effects and Risks, 1st Edition, Wiley, ISBN-13: 978-1118339596, ISBN-10: 1118339592

EN353 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT

1. Subject Code: **EN- 353** Course Title: **Occupational Health and Safety Management**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.) : Theory 3 Hrs
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Prerequisite : Nil
9. Course Objectives : 1. Introduction about occupational health and related issues.
2. To give a basic idea about environmental safety management, industrial hygiene.
3. To introduce about training cycle, chemical hazards and control measures.
4. To aware and provide knowledge about ergonomics and different disorders.
5. To provide knowledge about different standards related to safety and health.

10. Detail of Course:

Unit no.	Contents	Contact Hours
1	UNIT –I Definition of Occupational Health as per WHO/ILO. Occupational Health and Environmental Safety Management – Principles practices. Common Occupational diseases: Occupational Health Management Services at the work place. Pre-employment, periodic medical examination of workers, medical surveillance for control of occupational diseases and health records.	8

2	UNIT –II Occupational Health and Environment Safety Management System, ILO and EPA Standards. Industrial Hygiene: Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method, Personal hygiene, housekeeping and maintenance, waste disposal, special control measures.	8
3	UNIT –III Element of training cycle, Assessment of needs. Techniques of training, design and development of training programs. Training methods and strategies types of training. Evaluation and review of training programs. Chemical Hazard: Introduction to chemical hazards, dangerous properties of chemical, dust, gases, fumes, mist, Vapours, Smoke and aerosols. Evaluation and control of basic hazards, concepts of dose response relationship, bio-chemical action of toxic substances. Concept of threshold, limit values.	9
4	UNIT –IV Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety, Exposure Limit. Ergonomics-Introduction, Definition, Objectives, Advantages. Ergonomics Hazards. Musculoskeletal Disorders and Cumulative Trauma Disorders. Physiology of respiration, cardiac cycle, muscle contraction, nerve conduction system etc. Assessment of Workload based on Human physiological reactions. Permissible limits of load for manual lifting and carrying. Criteria or fixation limits.	9
5	UNIT –V Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000, OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001, EPA Standards, Performance measurements to determine effectiveness of PSM. Importance of Industrial safety, role of safety department, Safety committee and Function.	8
Total		42

Course Outcomes:

1. The student will be able to understand the basics of occupational health and related issues.
2. Understanding of the fundamental aspects of safety, industrial hygiene along with learning theory to safety training methodology.
3. Considerate about hazardous materials, emergency management, ergonomics and human factors

10. Detail of Course:

Unit no.	Contents	Contact Hours
1	Unit-1: Geographic Information System Introduction, Definition of GIS, Components of GIS, Input data for GIS, Geographical concepts	7
2	Unit-2:GIS Data GIS data types, Data representation, Data sources, Geo-referencing of GIS data, GIS database, Database Management System, Data analysis terminology, GIS software packages, GIS application	9
3	Unit-3:Remote Sensing Introduction to Remote Sensing and Remote Sensing System, Multi concept of remote sensing, Advantages and disadvantages of remote sensing, Electromagnetic radiation, Polarisation, Thermal radiation	8
4	Unit-4:Remote Sensing Platforms Important remote sensing satellites, Classifications of sensors and platforms, Passive and Active sensors, Major remote sensing sensors, Spatial resolution, Spectral resolution, Radiometric resolution, Temporal resolution, Global Positioning System	9
5	Unit-5:Application of Remote Sensing Digital Image Processing, Application of Remote Sensing in Land use and Land cover mapping, Ground water mapping, Urban growth studies, Wasteland mapping, Disaster management, Agriculture, Forestry application	9
Total		42

Course Outcomes:

1. The Student will learn about basics of GIS and its significance.
2. The Student will be able to understand the utility of GIS data as well as Data Management System.
3. The Student will learn the fundamentals of remote sensing.
4. The unit of Remote Sensing Platform will generate a clear cut understanding among students about the satellites, their functioning and Global Positioning System. Geographical information system, its components, DMS and its various applications in real life.
5. The Student will be able to attain thorough knowledge about the application of remote sensing in different areas.

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	Fundamentals of Remote Sensing – George Joseph, University Press, Hyderabad, India.
2.	Remote Sensing and Geographical Information System – AM Chandra & SK Ghosh Narosa Publishing House, New Delhi.
3.	Concepts and Techniques of Geographic Information Systems – C. P. Lo & Albert K.W. Yeung, PHI Learning Private Limited, New Delhi.
4.	Geographic Information System – Kang Tsung Chang, Tata Mc Graw hill, Publication Edition, 2002.

EP351 PHYSICS OF ENGINEERING MATERIALS

1. Subject code: **EP351** Course title: **Physics of Engineering Materials**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize the fundamentals /basic concepts and advances of the different materials keeping in view of the engineering applications. There is ample opportunity to become involved in cutting edge Materials Science and Engineering Research

10. Detail of Course:

Unit No.	Contents	Contact Hours
1.	Crystallography: Introduction to crystal physics, Space lattice, Basis and the Crystal structure, Bravais lattices; Miller indices, simple crystal structures, Interplanar spacing, Intra and Intermolecular bonds (Ionic, Covalent, Metallic, Van der Waals and Hydrogen Bond), Defects in crystals, Basics of X- ray diffraction and its applications	10
2.	Semiconductors: Band theory of solids, Intrinsic and Extrinsic semiconductors, Statistics of electrons and holes in intrinsic semiconductor, Hall effect, Effect of temperature on conductivity, Generation and recombination, drift and diffusion current, Einstein relation, Applications of Semiconducting Materials.	10
3.	Dielectric and Magnetic Materials <i>Dielectric Materials:</i> Dielectric polarization and dielectric constant, Various polarization processes, Applications of Dielectric Materials <i>Magnetic Materials:</i> Concept of Magnetism, Classification of dia-para, Ferro, Antiferro and Ferrimagnetism, ferrites, soft and hard magnetic materials, Applications of Magnetic Materials	07
4.	Superconductivity: Introduction and historical developments; General properties of super conductors, Meissner effect and its contradiction to the Maxwell's equation; Types of Superconductors, London equations, Penetration depth, High Temperature Superconductors, Applications of superconductors.	07
5.	Advanced Engineering Materials: Introduction, Synthesis, characterization and applications of Photonic glasses, Phosphors and Nanophosphors, other selective topics in advanced materials.	08
Total		42

11. Suggested Books:

S. No.	Name of Books/ Authors
1.	Introduction to Solid State Physics, by C. Kittel, 1996/ John Wiley & sons
2.	Solid State Physics, by S. O. Pillai, 2010/ New Age International (P) Ltd.
3.	Materials Science and Engineering by V. Raghavan, 2009/PHI Learning Pvt. Ltd.
4.	Solid State Physics, N. W. Ashcroft and N. D. Mermin, 1976/ HBC Publication
5.	Engineering Materials Science by Milton Ohring, 1995/Academic Press
6.	Material Science and engineering: An Introduction By W. D. Callister Junior, 2007/ John Wiley & Sons, Inc
7.	Handbook of Electronic and Photonic Materials by SafaKasap, Peter Capper (Eds.), 2006/Springer

EP353 NUCLEAR SECURITY

1. Subject code: **EP353** Course title: **Nuclear Security**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS:-- MTE: 25 ETE: 50 PRE: --
5. Credits : 3
6. Semester : V
7. Subject area : OEC
8. Pre-requisite : Basic knowledge of Nuclear Physics
9. Objective : This course will provide basic understanding of Nuclear Security which is essential for establishing nuclear culture in the society

10. Detail of Course:5th/6th Semester

S. No.	Contents	Contact Hours
1.	Introduction to nuclear security: Basics of nuclear security, Practice and culture, Background, Objective, Scope, Structure, Nuclear security and safety culture: Characteristics of nuclear security culture	08
2.	Nuclear security regime, Importance of human factor and management leadership in nuclear security, Nuclear security threats: Threat informed security, The design basis threat	07
3.	System characterization, PPS requirements and objectives: Facility characterization, Target identification, Consequence analysis, PPS performance objectives	06
4.	Physical protection system technologies: Intrusion detection, Exterior and Interior Sensors, Access control, Contraband detection, Field detection sensors at borders/major public Events, Alarm assessment, Communication and display, Access delay, Response and neutralization, Response strategies and impact of On and Off site response, Cyber security.	09
5.	Security system design and evaluation: Adversary path analysis and Multi path optimization, Scenario development, Insider analysis, Transportation, Design approaches and vulnerability assessments, System design at major public events, Design of security systems to interrupt illicit trafficking, Analysis of quantitative risk assessment methods.	08
6.	Consequence mitigation and event response: Consequence management following nuclear events, Analysis of deterrence value of security measures, Roles and responsibilities of institutions and individuals	04
Total		42

11. Suggested Books

S. No.	Name of Books/ Authors
1.	Nuclear security briefing book, by Wyn Bowen, Matthew Cottee, Chris Hobbs, Luca Lentini and Matthew Moran, 2014/King's College, London, UK
2.	IAEA Nuclear Security Series No. 13, Nuclear Security recommendations on physical protection of nuclear material and nuclear facilities by IAEA, 2011/International Atomic Energy Agency (IAEA)
3.	The International Legal Framework of Nuclear Security: IAEA International law series No. 4 by IAEA, 2011/International Atomic Energy Agency (IAEA)
4.	Seeking Nuclear Security Through Greater International Cooperation by Jack Boureston and Tanya Ogilvie-White, 2010/Council on Foreign Relations (CFR's) International Institutions
5.	Book Review: South Asia's Nuclear Security by Bhumitra Chakma , 2015/Oxon, UK, Routledge

HU351

1. Subject Code: **HU351** Course Title: **Econometrics**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective:

10. Details of Course

Unit	Contents	Contact Hrs
1.	Introduction Concept of Econometrics, methodology of Econometrics, types of Econometrics, Difference between Econometrics and Mathematical Economics, Type of Data, Sources of data, Estimating Economic Relationship	8
2.	Mathematics and Economic Application Differential Calculus and its application in Economics- Price and Cros Elasticity of demand, Profit maximization under Perfect Competition, Monopoly, Oligopoly and Monopolistic Competition Integral Calculus and its application in Economics - Capital Formation, Compound Interest; Capital value and Flow Value; Consumer surplus under pure competition and monopoly; Producers Surplus Differential Equation and its application in Economics – Market Price Function; Dynamic Multiplier;	12
3.	Regression Statistical verses Deterministic Relationships, Regression verses Causation; Two variable Regression Analysis; Population Regression Function (PRG), Stochastic specification of PRF; The Significance of the Stochastic Term; stochastic disturbance Term; the sample regression Function (SRF); Method of Ordinary Least Squares; Properties of Least Square Estimators: The Gauss-Markov Theorem, Coefficient of determination r^2 : A Measure of “goodness of fit”; Monto Carlo Experiments	8
4.	Classical Normal Linear Regression Mode (CNLRM) The Probability distribution of Disturbances (meu); Normality Assumption, Method of Maximum Likelihood Multiple regression Analysis: The Problem of estimation; The problem of Inference Cobb-Douglas Production function; Polynomial Regression Model; Testing for structural or Parametric stability of regression Models; the Chow test	6
5.	Dummy Variable (DV) Regression Models Nature; ANOVA models; Regression with a mixture of Quantitative and Qualitative regressors: The ANCOVA Models; DV alternative to the Chow Test; Interaction effects using Dummy Variable; Use of DV in seasonal Analysis	6
Total		40

11. Suggested books

S.No.	Name of Books, Authors, Publishers
1.	Wooldridge Jeffrey , Introductory Econometrics, Cengage Learning- ISBN-13-978-81-315-1673-7; ISBN-1081-315-1673-3,2014
2.	Damodar N. Gujrati, Basic Econometrics, Mcgraw Hill Education (India) Limited, Fifth Edition,2013 ISBN-978-0-07-133345-0; ISBN; 0-07-133345-2
3.	Ramu Ramanathan, Introductory Econometrics with Applications, Harcourt Brace Jovanovich Publishers, Latest USA ISBN-

MA351 HISTORY CULTURE & EXCITEMENT OF MATHEMATICS

- 1 Subject code: **MA351** Course title: **History Culture and Excitement of Mathematics**
2. Contact Hours : L-3 T-0 P-0
3. Examination Duration (Hrs) : Theory: 3hrs
4. Relative weightage : CWS: 25 PRS: - MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre requisite : --
9. Objective: To be capable in learning the history and culture on the Mathematics subjects

Unit No.	Contents	Contact Hours
1.	Ancient, Medieval and Modern Indian Mathematics: Aryabhata, Brahmagupta, Bhaskar, Lilavati, Ramanujan	7
2	Introduction to Ancient books of Indian Mathematicians: Sidhantas, Sulvasutras, Vedic Mathematics	7

3	Contribution of Indian Mathematicians in the field of Mathematics: Value of Pi, The symbol zero, Number theory, Trigonometry, and Mensuration, Hindu Multiplication, Long Division, Indeterminate equation	7
4	Mathematicians Around the world: Newton, Leibnitz, Cauchy, Lagrange in the field of Geometry, Calculus, Algebra, Probability	7
5	Algebra in the Renaissance: Solution of cubic equation, Ferrari's Solution in the quartic equation, Irreducible Cubics and complex numbers	7
6	Paradoxes, Fallacies and Pitfalls of Mathematics	7
Total		42

11. Suggested books

S.No.	Name of Books, Authors, Publishers
1.	History of Mathematics, by Carl B Boyer, Wiley International edition, 1968.
2.	Mathematics of Music, Susan Kelly, UW-L Journal of under graduate research, Vol-XIV, 2011.

ME 351 POWER PLANT ENGINEERING

- | | |
|--------------------------------|---|
| 1. Subject Code: ME 351 | Course Title: Power Plant Engineering |
| 2. Contact Hours: 42 | : L: 3 T: 0 P: 0 |
| 3. Examination Duration (Hrs.) | : Theory: 3 Practical: 0 |
| 4. Relative Weight | : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0 |
| 5. Credits | : 3 |
| 6. Semester | : V |
| 7. Subject Area | : OEC |
| 8. Pre-requisite | : NIL |
| 9. Objective | : To familiarize the students with thermodynamic cycles and various components of power plants. |

10. Details of Course:

S. No.	Contents	Contact Hours
1	Indian energy scenario, Indian coals: formation, properties, analysis, beneficiation and heating value calculation of coals; coking and non-coking coals, fuel handling systems; coal gasification. Classification of power plants, base load and Peak load power stations, co-generated power plant, captive power plant, and their fields of application & selection criteria,.	7
2	Steam Generators: High pressure utility boiler, natural and forced circulation, coking and non-coking coal, coal beneficiation, coal pulverization, pulverized fuel firing system, combustion process, need of excess air, cyclone furnace, fluidized bed boiler, electrostatic precipitators and wet scrubbers, boiler efficiency calculations, water treatment.	7
3	Combined Cycle Power Plants: Binary vapour cycles, coupled cycles, gas turbine- steam turbine power plant, gas pipe line control, MHD-Steam power plant.	7
4	Other power plants: Nuclear power plants - working and types of nuclear reactors, boiling water reactor, pressurized water reactor, fast breeder reactor, controls in nuclear power plants, hydro power plant -classification and working of hydroelectric power plants, tidal power plants, diesel and gas power plants.	7
5	Instrumentation and Controls in power plants: Important instruments used for temperature, flow, pressure, water/steam conductivity measurement; flue gas analysis, drum level control, combustion control, super heater and re-heater temperature control, furnace safeguard and supervisory system (FSSS), auto turbine run-up system(ATRS).	7
6	Environment Pollution and Energy conservation: Economics of power generation: load duration curves, power plant economics, pollution from power plants, disposal/management of nuclear power plant waste, concept of energy conservation and energy auditing.	7
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Power Plant Engineering by M.M. Elwakil, Tata McGraw Hill, ISBN- 0070662746.
2	Power Plant Engineering by P.K Nag, Tata McGraw Hill, ISBN- 0070435993.
3	Steam and Gas turbines by A Kostyuk and V Frolov, MIR Publishers, ISBN- 9785030000329.
4.	Modern Power Plant Engineering by J Wiesman and R Eckart, Prentice hall India Ltd, ISBN- 97801359725.
5.	Planning Fundamentals of thermal Power Plants by F.S Aschner, John Wiley, ISBN- 07065159X.
6.	Applied Thermodynamics by T.D Eastop and McConkey, Longman Scientific and Technical, ISBN- 0582305351.
7.	CEGB volumes on power plant, Cwntral Electricity Generation Board, ISBN- 0080155680.
8.	NTPC/NPTI publications on Power plants, ISBN- 9788132227205.

ME353 RENEWABLE SOURCES OF ENERGY

- | | |
|--------------------------------|---|
| 1. Subject Code: ME 353 | Course Title: Renewable Sources of Energy |
| 2. Contact Hours: 42 | : L: 3 T: 0 P: 0 |
| 3. Examination Duration (Hrs.) | : Theory: 3 Practical: 0 |
| 4. Relative Weight | : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0 |
| 5. Credits | : 3 |
| 6. Semester | : V |
| 7. Subject Area | : OEC |
| 8. Pre-requisite | : NIL |
| 9. Objective | : To familiarize the students with renewable energy sources like solar, geothermal, wind and tidal. |

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Man and Energy, world production and reserve of conventional energy sources, Indian production and reserves, Energy alternatives	7
2	Solar radiation: Origin, nature and availability of solar radiation, estimation of solar radiation. Photovoltaic cells. Design consideration and performance of different types of solar cells. Flat plate, focusing collectors. Effects of receiving surface location and orientation.	7
3	Devices for solar thermal collection and storage. Energy storage devices such as water storage systems, packed Bed storage systems, phase change storage systems. Heat transfer considerations relevant to solar energy. Characteristics of materials and surfaces used in solar energy absorption.	7
4	Application systems for space heating, solar water pumps, solar thermal pond, Solar Thermal Power plants, solar distillation, Solar Refrigeration and solar air conditioning, other solar energy utilization.	7
5	Solar PV systems. Fuel Cell Technologies. Generation and utilization of biogas, design of biogas plants, Wind energy systems.	7
6	Geothermal Energy Systems. Tidal energy systems. Oceanic power generation. Design considerations, Installation and Performance Evaluation. MHD power generations. Role of the nonconventional energy sources in power planning.	7
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	G. D. Rai, "Energy Technolgy", Khanna Publishers, ISBN- 97881740907438.
2	S.P. Sukhatme, " Solar Energy", Tata-Mcgraw hill, New Delhi, ISBN- 0074624531.
3	"Solar Energy thermal process" JADuffie and W.A. Beckman, John Wiley& sons, New York, ISBN- 1118418123.

4	Solar energy, Frank Kaieth& Yogi Goswami, Taylor and Francis, ISBN- 1560327146.
5	Treatise of Solar Energy, H.P. Garg, John Willey & sons, ISBN- 9027719306.

ME355 COMBUSTION GENERATED POLLUTION

1. Subject Code: **ME 355** Course Title: **Combustion Generated Pollution**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To introduce the students to different types of fuels, emissions from various engines, exhaust treatment of various engines and instruments used for measuring emissions.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Engine fundamentals: Fuels, alternative fuels for IC engines, Type of hydro carbons. Gasoline specifications. Effect of Engine parameters on performance, fuel injection for SI engines, Engine vehicle road performance, road performance and fuel economy.	7
2	Emissions and air pollution: Automotive Emissions and their role in air pollution. Photo-chemical smog. Chemistry of smog formation. Combustion in Homogeneous mixtures, emission formation. Incomplete combustion, formation of hydro-carbons, Carbon monoxide and oxides of nitrogen, Aldehyde emissions.	7

4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarise the students with the process of thermodynamic analysis of engineering systems and to enhance critical thinking and provide them with a wider view to handle engineering problems.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Fundamentals: properties of pure substance in Solid, Liquid and Vapour Phases, PVT Behavior of simple compressible system, T-S and H-S diagram, Steam Tables, determination of quality of steam, Throttling Calorimeter, Combined Separating & Throttling Calorimeter, Maxwell and other thermodynamics relations, mixture of non reactive ideal gases, Real gases, Compressibility chart, Law of corresponding state, Air water vapor mixture, calculation of properties of air water vapour mixture.	7
2	Rankine Cycle And Analysis: Rankine cycle and its representation on T-S and H-S diagrams; Effect of low backpressure and high entry pressure and temperature and its limitations; necessity of re-heating, ideal and actual regenerative feed water heating cycle and its limitations. Typical feed water heating arrangements for various capacity power plants.	7
3	Introduction To Boilers: Classification of Boilers, Boiler mountings and accessories; draft systems, circulation system; Combustion and its calculations, and Boiler performance.	7
4	Steam Nozzles: Types of Nozzles, Flow of steam through nozzles; Condition for maximum discharge through nozzle; Nozzle efficiency. Effect of friction and Supersaturated flow through nozzle.	7

5	Steam Turbines : Working principle and types of steam turbines; Velocity diagrams for impulse and reaction turbines, compounding of impulse turbines; Optimum velocity ratio and maximum efficiency. Comparison of impulse and reaction turbines. Condition line and reheat-factor, losses in steam turbines; governing of steam turbines.	7
6	Condensers and Cooling towers: Types and working of condensers, types and performance of cooling towers.	7
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Engineering Thermodynamics by P.K.Nag, Tata McGraw Hill Publishing Company Limited, ISBN – 1259062562, 2013.
2	Engineering Thermodynamics by Rogers, Pearson Education, ISBN- 631197036.
3	Thermodynamics by Kenneth Wark, Mcgraw-hill Book Company, 5 th edition, ISBN- 0070682860, 1988.
4.	Engineering Thermodynamics: work and heat transfer by Gordon Rogers and Yon Mayhew, Longman, 4 th edition, ISBN – 0471861731, 1992.
5.	Fundamentals of Classical Thermodynamics by Van Wylen and Sonntag, John Wiley & Sons Inc., 3 rd edition, ISBN – 0471861731, 1986.
6.	Fundamentals of Engineering Thermodynamics by Moran and Shaprio, John Wiley & Sons, Inc., 7th edition, ISBN – 0470917687, 2010.
7.	Thermodynamics: An Engineering Approach by Cengel and Boles, The McGraw-Hill Companies, 8 th edition, ISBN: 0073398179, 2014.
8.	Applied Thermodynamics for Engineering Technologists by T.D. Eastop, Prentice Hall, 5 th edition, ISBN- 05820919344, 1993.
9.	Treatise on Heat Engineering by V. P.Vasandani and D.S. Kumar, Metropolitan Book Co. (p) Ltd., ISBN- 810003500.

ME359 REFRIGERATION & AIR CONDITIONING

1. Subject Code: **ME 359** Course Title: **Refrigeration and Air Conditioning**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To learn properties of different refrigerants, and thermodynamic cycles of refrigeration. To understand comfort parameters and air conditioning.
10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction to Refrigeration: Necessity and applications, unit of refrigeration and C.O.P., types of Ideal cycles of refrigeration, air-refrigeration, bell coleman cycle, open and dense air systems, actual air-refrigeration system problems, refrigeration needs of aircrafts, actual refrigeration system	7
2	Vapour Compression Refrigeration: Working principle and essential components of the plant, simple vapour compression refrigeration cycle - COP, Representation of cycle on T-S and p-h charts - effects of sub cooling and super heating - cycle analysis - Actual cycle, Influence of various parameters on system performance – necessity of multistaging, multistage compression system, and their analysis, necessity and working of cascading system	10

3	Refrigerants and Absorption Refrigeration: Desirable properties of refrigerants, classification of refrigerants used, nomenclature, ozone depletion, global warming, vapor absorption system, calculation of max COP.	4
4	Air Conditioning: Psychometric properties & processes, comfort air-conditioning, summer and winter air-conditioning, cooling & dehumidification systems, load calculation and applied psychrometry.	7
5	Human Comfort: Requirements of human comfort and concept of effective temperature, comfort chart, comfort air-conditioning, requirements of industrial air-conditioning, air-conditioning load calculations.	7
6	Control: Refrigeration and air-conditioning control, air handling, air distribution and duct design	7
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Refrigeration and Air Conditioning by C. P. Arora, Tata McGraw Hill, ISBN-9788120339156.
2	Refrigeration and Air Conditioning by A. R .Trott and T. C. Welch, Butterworth-Heinemann, ISBN- 9780080540436.
3	Refrigeration and Air ConditioningTechnology by Whitman, Jhonson and Tomczyk, Thomson Delmer Learning, ISBN- 1111644470.
4	Refrigeration and Air Conditioning by Abdul Ameen, Prentice Hall of India Ltd, ISBN- 9789303206560..
5	Basic Refrigeration and Air Conditioning by P. N. Ananthanarayan, Tata McGraw Hill, ISBN- 9789383286560.
6	Refrigeration and Air Conditioning by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill, ISBN- 007061623X.
7.	Refrigeration and Air Conditioning by Richard Charles Jordan, Gayle B. Priester, Prentice hall of India Ltd, ISBN-9780406269313.

3	Production Planning and Control Types and characteristics of production systems Objective and functions of Production, Planning & Control, Routing, Scheduling and Operations scheduling, production scheduling, job shop scheduling problems, sequencing problems, scheduling tools and techniques, Loading, Dispatching and its sheets & Gantt charts	7
4	Quality Engineering Quality concept and costs; statistical quality control, Concept of specification limits, statistical control limits, process capability, Process control and control charts for both attributes and variable data. Acceptance Sampling- Single and double sampling	7
5	Reliability and Maintenance Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; system reliability determination; Maintenance management and its objectives, Various types of Maintenance Planning, House Keeping, 5S concepts	7
6	Material Handling Principles, functions, and objectives of Material Handling; Selection and classification of Material Handling Equipments; Relation of material handling with plant layout	7
Total		42

11. Suggested Books

S. No.	Name of Authors /Books / Publishers
1	Industrial Engineering and Management; B. Kumar, Khanna Publication, ISBN- 8174091963, 2011.
2	Introduction to work Study, International Labour Office, Geneva, 3 rd edition, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi, ISBN- 8120406028, 2008.
3	Industrial Engineering and Management, Pravin Kumar, Pearson Education, 1 st edition, ISBN- 9789332543560, 2015.

5	Material selection: Materials in design. The evolution of engineering materials. Design tools and material data. Material selection strategy, attribute limits, selection process, material selection. Case studies	5
6	Process selection: Introduction. Process classification: shaping, joining and finishing. Systematic process selection, process cost. Computer – aided process selection	5
7	Design for manufacture and assembly: Design for Manufacture and Assembly (DFMA). Reasons for not implementing DFMA. Advantages of DFMA with case studies. Design features and requirements with regard to assembly, Design for Manufacture in relation to any two manufacturing processes: machining and injection molding. Need, objectives	4
8	System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages	4
9	Simulation of Mechanical Systems: Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems	4
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
TEXT BOOKS:	
1	David G Ullman, “The Mechanical Design Process.” Publisher- McGrawhillIncSingapore, ISBN-13: 9780072975741, 1992.
2	Kevin Otto & Kristin Wood Product Design: “Techniques in Reverse Engineering and new Product Development.” 1 / e 2004 , Publisher- Pearson Education New Delhi , ISBN-13: 9780130212719,
3	L D Miles “Value Engineering.”Publisher- McGraw-Hill, 1972
4	Karl T Ulrich, Steven D Eppinger , “ Product Design &Development.”Publisher- Tata McGrawhill New Delhi, ISBN-13: 9780078029066, 2003

4	Basic Aspects of Discretization: Introduction to Finite Difference, Finite Elements and Finite Volume Methods. Detailed treatment of Finite Difference method, explicit and implicit methods, errors and stability analysis.	12
5	Grids with Appropriate Transformations Adaptive grids and unstructured meshes. Lift reduction, down force generation and drag reduction. An introduction to the aerodynamics of airflows for cooling.	7
6	Commercial codes (e.g. FLUENT etc.). Grid generation, techniques and application. Basic principles and concepts and the characteristics of wings and diffusers	7
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Computational Fluid Dynamics", John Anderson," McGraw- Hill Ltd.
2	Computational Fluid Dynamics", Tu, Elsevier.
3	Introduction to Computational Fluid Dynamics, Niyogi, Pearson Education, Delhi

ME367 FINITE ELEMENT METHODS

1. Subject Code: **ME 367** Course Title: **Finite Element Methods**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC

8. Pre-requisite : NIL
9. Objective : To enable students to apply Galerkin method and virtual work principle to problems in solid mechanics. To teach them numerical solution of differential equations with finite element method.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Fundamental concepts of the Finite Element Method. One Dimensional Problem(Bar of uniform and variable cross sections), The Galerkin Approach, The potential –Energy Approach, shape Functions, Derivation of stiffness matrix and load vector for the element and for the entire domain. Evaluation of displacement, stresses and reaction forces.	12
2	Trusses :- Introduction, Plane Trusses, Local and Global coordinate Systems, Element Stiffness Matrix and Stress calculations	3
3	Two –Dimensional problem using Constant strain triangles(CST), Two-dimensional isoparametric elements and numerical integration ,element stiffness matrix, Force vector.	6
4	Applications of finite element method to heat transfer.	4
5	Application of finite element method to electrical systems.	10
6	Dynamic analysis :- Element mass matrices,Evaluation of Eigenvalues and Eigenvectors. Use of Softwares such as MAT LAB/ABAQUS/ANSYS/ NASTRAN/ IDEAS. Basic feature of these softwares.	7
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Finite Element Procedures, K.J. Bathe, Prentice Hall of India.
2	Finite Elements in Engineering by Chandrupatla and Belegundu.
3	Finite element Method by J.N.Reddy.
4.	Finite element Method,O.C. Zienkiewicz& R.A. Taylor
5.	Finite element Analysis,C.S. Krishnamurthy
6.	Finite element Method, Kenneth H. Hubener
7.	Finite Element Method, Desai & Abel

ME369 TOTAL LIFECYCLE MANAGEMENT

1. Subject Code: **ME 369** Course Title: **Total Lifecycle Management**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concept of Total Life Cycle, and applying life cycle thinking to define tradeoffs. This course also introduces to sustainability and use of renewable resources.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction: Extensive definition of Concurrent Engineering (CE), CE design methodologies, Review of CE techniques like DFM (Design for manufacture), DFA (Design for assembly), QFD (Quality function deployment), RP (Rapid prototyping), TD (Total design), for integrating these technologies, Organizing for CE, CE tool box, Collaborative product development	8
2	Use of Information Technology: IT support, Solid modeling, Product data management, Collaborative product Commerce, Artificial Intelligence, expert systems, Software hardware component design.	8
3	Design Stage: Lifecycle design of products, Opportunities for manufacturing enterprises, Modality of concurrent engineering design, automated analysis, Idealization control, CE in optimal structural design, Real time constraints	8
4	Need for PLM: Importance of PLM, Implementing PLM, Responsibility for PLM, Benefits to different managers ,Components of PLM, Emergence of PLM, Lifecycle problems to resolve, Opportunities to seize	9
5	Components of PLM: Components of PLM, Product lifecycle activities, Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards	9
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Integrated Product Development M.M. Anderson and L Hein IFS Publications
2	Design for Concurrent Engineering J. Cletus CE Research Centre, Morgantown
3	Concurrent Engineering Fundamentals: Integrated Product Development Prasad Prentice hall India

4	Concurrent Engineering in Product Design and Development I Moustapha New Age International
5	Product Lifecycle Management John Stark Springer-Verlag, UK
6	Product Lifecycle Management Michael Grieves McGraw Hill
7	Concurrent Engineering: Automation tools and Technology Andrew Kusiak Wiley Eastern

ME371 VALUE ENGINEERING

1. Subject Code: **ME 371** Course Title: **Value Engineering**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To understand the concept and approaches of value analysis and engineering with an emphasis on case studies.
10. Details of Course:

Unit No.	Contents	Contact Hours
1	An Overview Of Value Engineering-Concepts and approaches of value analysis and engineering - importance of value, Function - identity, clarify – analysis	8

8. Pre-requisite : Nil
9. Objective : Familiarizing the students with the financial environment of business, especially the financial markets and acquaint them with accounting mechanics, process and system.

10. Details of Course:

Unit No.	Detail Contents	Contact Hours
1	Introduction to Management :Basic concepts of management, management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2	Introduction to Financial Environment and accounting: Financial Markets - Capital Markets, Basics of capital market mechanism, instruments, financing and rating institutions. Importance, Objectives and Principles of Accounting, Accounting Concepts and conventions, and the Generally Accepted Accounting Principles (GAAP) Overview of the Accounting Process. Accounting standards as Issued by Institute of Chartered Accountants of India (ICAI).	10
3	Overview of Business Activities and Principal Financial Statements: Observe the types of information provided by the three principal financial statements and how firms might use this information in managing and evaluating a business. Understand the rationale and the information value of the statements of Balance Sheet, Profit and Loss statement, cash flows.	8
4	Financial Analysis-I: Distinction between cash profits and book profits. Understanding the cash flow statement and the funds flow statement.	8
5	Financial Analysis –II: Importance, objectives and concept of Ratio Analysis- Liquidity, leverage, solvency and profitability ratios.	8
Total		42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,2011, ISBN- 978-0273755869
2	Introduction to Accountancy, 10 ed., T.S. Grewal, S. Chand and Company (P) Ltd., New Delhi,2009, ISBN- 9788121905695
3	Advance Accounts by M.C Shukla and T.S Grewal and SC Gupta, S. Chand and Company (P) Ltd., New Delhi,1997, ISBN- 9788121902786
4	Financial Accounting, 4 ed, S.N. Maheshwari and S.K. Maheshwari, Vikas Pulication,2005, ISBN- 8125918523
5	Financial Accounting Reporting & Analysis, Cengage, 7/e, W Albrecht Stice & James Stice, Cengage Learning,2010, ISBN- 0538746955

MG353 FUNDAMENTALS OF MARKETING

1. Subject Code : **MG353** Course Title : **Fundamentals of Marketing**
2. Content Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory: 3 Hrs Practical 0
4. Relative Weightage : CWS:25 PRS MTE:25 ETE:50 PRE
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : The basic objective of this paper is to make students aware of fundamental concepts of marketing necessary for making decisions in complex business situations by managers and start up entrepreneurs.

10. Details of Course:

Unit No.	Detail Contents	Contact hours
1	Basic concepts of management: management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2	Introduction to marketing: nature and scope of marketing, marketing mix, marketing vs. sales, role of marketing in society, interface of marketing with other departments in organization, Customer Life Time Value, ethical issues in marketing Concept of market segmentation: consumer and industrial, targeting and positioning, sales forecasting	9
3	Product mix decisions: new product development process, test marketing, concept of Product Life Cycle, product packaging decisions	8
4	Pricing decisions : consideration in setting price, major pricing strategies, promotional mix decisions: advertising, sales promotion, personal selling, publicity, opportunities and avenues of online promotion	9
5	Promotion and distribution decisions : design and management of distribution channel for physical products and services, reasons of channel conflict, handling strategies, basic challenges in supply chain management of e-commerce firms	9
Total		42

11. Suggested Books

Unit No.	Name of Books / Authors/ Publishers
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011, ISBN-978-0273755869
2	Marketing Management, 14 th ed., Philip Kotler , Kevin Lane Keller, Abraham Koshy and MithileswarJha, Pearson Education, New Delhi, 2013,(ISBN-10: 9788131767160)

3	Marketing, 14 th ed., Etzel, Bruce J Walker, William J Stanton and Ajay Pandit, Mc Graw Hill Education, 2009, ISBN -9780070151567
4.	MKTG, Charles W Lamb, Joe F Hair, Carl NcDaniel and Dheeraj Sharma, Cengage Learning,2012, ISBN- 9788131517086
5.	Marketing Management, RajanSaxena, Tata Mc Graw Hill Education, 2005, ISBN- 9780070599536

MG355 HUMAN RESOURCE MANAGEMENT

1. Subject Code : **MG355** Course Title : **Human Resource Management**
2. Content Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory: 3 Hrs Practical 0
4. Relative Weightage : CWS:25 PRS MTE:25 ETE:50 PRE
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : To develop necessary understanding in design and execution of human resource strategies for the achievement of organization goals.
10. Details of Course:

Unit No.	Content	Contact hours
1.	Basic concepts of management: management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8

2.	Introduction: Concept, nature, scope, objectives and importance of HRM; Evolution of HRM; Environment of HRM; Personnel Management vs HRM. Acquisition of Human Resources: HR Planning; Job analysis – job description and job specification; recruitment – sources and process; selection process – tests and interviews; placement and induction. Job changes – transfers, promotions/demotions, separations.	9
3.	Training and Development: Concept and importance of training; types of training; methods of training; design of training programme; evaluation of training effectiveness; executive development – process and techniques; career planning and development.	8
4.	Performance Appraisal: Performance appraisal – concept and objectives; traditional and modern methods, limitations of performance appraisal methods.	8
5.	Compensation and Maintenance: Compensation: job evaluation – concept, process and significance; components of employee remuneration – base and supplementary; maintenance: overview of employee welfare, health and safety, social security.	9
Total		42

11. Suggested Books

S. No	Name of the book /Authors /Publishers
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011, ISBN-978-0273755869
2	Human Resource Management, G. Dessler, B. Varkkey, Pearson prentice Hall, 2011, (ISBN – 978-81-317-5426-9)
3	International HRM a cross cultural approach, T. Jackson, Sage publications, London, 2002, (ISBN – 0-7619-7404-0)
4	HRM and Performance: Achievements and Challenges, D. E. Guest, J .Paauwe, P. Wright, John Wiley and sons, UK, 2013, (ISBN – 978-1-118-48261-2)
5	A Handbook of Human Resource Management Practice, M. Armstrong, Kogan Page Limited, UK, 2007 ,(ISBN – 978–0–7494–4631-4)

MG357 KNOWLEDGE AND TECHNOLOGY MANAGEMENT

1. Subject Code : **MG 357** Course Title : **Knowledge and Technology Management**
2. Content Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.) : Theory: 3 Hrs Practical 0
4. Relative Weightage : CWS:25 PRS MTE:25 ETE:50 PRE
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : Preparing the students to understand how the new age organizations are leveraging on the power of knowledge and technology. Acquiring the knowledge to address the issues faced by the corporate world for a deeper understanding.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Basic concepts of management , management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2.	Introduction to Knowledge Management: Data, Information, Knowledge Management (KM), Knowledge Society, Knowledge Economy, Types of Knowledge, Tacit knowledge and explicit knowledge, Essential components of KM model Building Knowledge Assets: Various knowledge assets, Tools of Knowledge, Knowledge Audit, AAR (After Action Review), Analyzing current knowledge state.	9

3.	Creating Strategies for Success: KM strategy, Codification, Personalization, Knowledge Management Implementation, Generating a KM-specific vision, Integrating organizational and business goals with KM, Choosing the right KM techniques, Relevant case studies in this area.	9
4.	Understanding Technology: Definition, Key concepts, Need for technology, History of technological developments, Role and importance of technology in 21st century, Recent developments in the field of technology.	8
5.	Technology-Management integration: Management as a concept, Technology management, Life cycle approach to technology management, Innovation, Creativity, Technology innovation process.	8
Total		42

11. Suggested Books

S. No.	Name of Books /Authors/Publishers
1.	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,2011, ISBN-978-0273755869
2	Knowledge Management in Organizations: A Critical Introduction, Donald Hislop, Oxford University Press,2013, ISBN: 9780199691937.
3	The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, IkujiroNonaka and Hirotaka Takeuchi, Oxford University Press,1995, ISBN: 0195092694.
4	Hitotsubashi on Knowledge Management (Hardcover), Hirotaka Takeuchi and IkujiroNonaka, John Wiley and Sons, 2004, ISBN: 0470820748.
5	Management of Technology: The Key to Competitiveness and Wealth Creation, Tarek Khalil and Ravi Shankar, McGraw Hill Education (India) Private Limited, 2nd Edition, 2012, ISBN: 9780070677371.

PE351 ADVANCED MACHINING PROCESS

1. Subject Code: **PE-351** Course Title: **Advanced Machining Process**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To understand basic principles of various processes and their applications. State various parameters influencing the machining process.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction, need of advanced machining processes, hybrid processes, microelectro mechanical system, (MEMS), nano electromechanical systems(NEMS),Ultrasonic micro machining - mechanics of cutting, parametric analysis, process capabilities, applications.	7
2	Abrasive jet machining: Introduction, set ups, gas propulsion system, abrasivefeeder, machining chamber, AJM nozzle, abrasive parametric analysis, processcapabilities, applications, abrasive micro machining, Water jet machining:Introduction, process characteristics, process performance, applications, Abrasive Water jet machining: Abrasive finishing process: Working principle, parametric analysis, process variables, process performance and applications,	8

3	Abrasive flow machining- Working principle, parametric analysis, process variables, process performance and applications, Magnetorheological abrasive flow finishing- Working principle, parametric analysis, process variables, process performance and applications, Magnetic float polishing, Magnetic abrasive finishing- Working principle, parametric analysis, process variables, process performance and applications	10
4	Electro discharge machining (EDM): Introduction, Working principle, parametric analysis, process variables, process characteristics, applications, hybrid processes such as electro discharge grinding, diamond grinding, wire EDM, Electro discharge micro grinding,	7
5	Laser beam machining- production of laser, working principle, types of laser, process characteristics and applications. Electron beam machining: Working principle, process parameter, process characteristics, and applications. Ion beam machining: Working principle, process parameter, process characteristics, and applications.	8
6	Plasma arc machining: Working principle, Plasma arc cutting system, applications.	2
Total		42

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1	Advanced machining process, Dr.V.K.Jain, Allied publisher, ISBN:978-81-7319-915-8.
2	Non traditional methods of manufacturing, Shan&Pandey, ISBN, 0070965536

PE353 SUPPLY CHAIN MANAGEMENT

- | | |
|--------------------------------|--|
| 1. Subject Code: PE-353 | Course Title: Supply Chain Management |
| 2. Contact Hours | : L: 3 T: 0 P: 0 |
| 3. Examination Duration (Hrs.) | : Theory: 3 Practical: 0 |
| 4. Relative Weight | : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0 |
| 5. Credits | : 3 |

6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To understand the key considerations at the various stages involved in the supply of product in order to maintain the smooth flow from source to the point of consumption so that overall organizational performance may improve.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction: Perspective of Supply Chain Management, Managing uncertainty, Key issue in supply chain management.	6
2	Inventory Management and Risk Pooling: Inventory management, Classification of inventory, Centralized versus Decentralized Warehousing and Risk pooling, Value of Information, Quantification of Bullwhip effect, Causes and remedies of Bullwhip effect.	8
3	Resource planning: Aggregate Production Planning- Chase and leveling strategies, MRP, MRP-II, Agile manufacturing Systems	6
4	Procurement and Outsourcing strategies: Introduction, outsourcing benefits and risks, Make/Buy decision, e-procurement, Vendor selection and quota allocation.	7
5	Strategic Alliances: Introduction, Third party logistics, Demand driven strategies, Distribution strategies- direct shipment, cross docking, transshipment, Supplier relationships management, Customer relationship management.	8
6	International Issues in Supply Chain Management: Concepts in Globalization, Globalization forces, Risks and Advantages of International supply chains, Issues in International supply chain management, Regional differences in logistics.	7
Total		42

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1.	Simchi-Levi, Kaminsky, Philip K. and 'Designing and Managing the Supply Chain: Concepts, Strategic and Case Studies', McGraw-Hill/Irwin, (ISBN, 10: 0072357568, 13: 978-0072357561).
2	Supply Chain Management by Chopra and Mendle, ISBN: 9780132743952
3	Supply Chain Management: Text and Cases by JannatSah., ISBN-10: 8131715175.

PE355 WORK STUDY DESIGN

1. Subject Code: **PE-355** Course Title: **Work Study Design**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To provide basic understanding to the students about the concept and significance of work study and ergonomics. To impart thorough knowledge to the students about various techniques of work-study for improving the productivity of an organization.

10. Details of Course:

Unit No.	Contents	Contact Hrs
1	Productivity: Definition, reasons for low productivity, methods to improve productivity, Work-study and productivity	4

2	Human factor in work-study: Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.	5
3	Method-study: Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph, therbligs, micro motion study and film analysis, Simo chart, principles of motion economy. Development and installation of new method..	9
4	Work-Measurement: Definition, various techniques of work-measurement work-sampling, stopwatch time study & its procedure, Job selection, Equipment and forms used for time study, rating, methods of rating, allowances and their types, standard time, numerical problems, predetermined - time standards and standard data techniques. Incentive: Meaning, objectives of an incentive plan, various types of incentive plans	9
5	Ergonomics: Introduction, history of development, man-machine system and its components. Introduction to structure of the body- features of the human body, stress and strain, metabolism, measure of physiological functions- workload and energy consumption, biomechanics, types of movements of body members, strength and endurance, speed of movements. NIOSH lifting equation, Lifting Index, Maximum acceptable Weights and Forces, Distal upper extremities risk factors, Strain Index, RULA, REBA.	8
6	Applied anthropometry - types, use, principles in application, design of work surfaces and seat design. Visual displays for static information, visual displays of dynamic information, auditory, tactual and olfactory displays and controls. Assessment of occupational exposure to noise, heat stress and dust .Effect of vibration/ noise, temperature, illumination and dust on human health and performance	7
Total		42

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1.	Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, ISBN-10: 8126522178, 2009.

2	Marvin E, Mundel& David L, "Motion & Time Study: Improving Productivity", Pearson Education, ISBN-10: 0136030440 , 2000.
3	Benjamin E Niebel and FreivaldsAndris, "Methods Standards & Work Design", McGraw Hill, ISBN-101259064840 , 1997.
4	International Labour organization, "Work-study", Oxford and IBH publishing company Pvt. Ltd., N.Delhi, ISBN-10 8120406028 , 2001

PE357 PRODUCT DESIGN & SIMULATION

1. Subject Code: **PE-357** Course Title: **Product Design & Simulation**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To allow students to develop the technical, analytical, and managerial skills necessary to perform the tasks successfully.

10. Details of Course:

Unit No.	Content	Contact Hours
1	Stages in design process: Introduction to various stages of the design process: Formulation of problem, Generate alternatives, Evaluation, Guided Redesign. Case study.	6

2	<p>Product life cycle: New product introduction: early introduction, increased product life. Life cycle management tool, System integration, QFD, House of quality, Pugh's method, Pahl and Beitz method. Case studies.</p>	6
3	<p>Value engineering:Introduction, nature and measurement of value. Value analysis, job plan. Creativity and techniques of creativity. Value analysis test. Case studies.</p> <p>Material selection:Materials in design. The evolution of engineering materials. Design tools and material data. Functional material, shape and process. Material selection strategy, attribute limits, selection process, common methods of material selection. Case studies.</p>	6
4	<p>Concurrent/ reverse engineering: Introduction, basic principles, components, benefits of concurrent engineering. Concept of reengineering.</p> <p>Process selection: Introduction. Process classification: shaping, joining and finishing. Systematic process selection, Ranking, process cost. Computer – aided process selection.</p>	6
5	<p>Design for manufacture and assembly:Design for Manufacture and Assembly (DFMA). Reasons for not implementing DFMA. Advantages of DFMA with case studies. Design features and requirements with regard to assembly, product Design for Manufacture in relation to any two manufacturing processes: machining and injection molding. Need, objectives.</p>	8
6	<p>System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature ofsimulation, Numerical computation techniques, Continuous system models, Analog andHybrid simulation, Feedback systems, Computers in simulation studies, Simulation softwarepackages.</p> <p>Simulation of Mechanical Systems: Building of Simulation models, Simulation oftranslational and rotational mechanical systems, Simulation of hydraulic systems.</p>	10
Total		42

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1	Product Design and Development , “Karl T. Ulrich, Steven D. Eppinger”Mc GrawHill. ISBN:9780072296471
2	Integrated Product and Process Development , “John M. Usher, Utpal Roy and H. R. Parasaei. ISBN: 978-0-471-15597-3
3	Product Design for Manufacture and Assembly , “G. Boothroyd, P. Dewhurst and W. Knight” MarceDaker. ISBN:978-1420089271
4.	Engineering Design and Design for Manufacturing: A structured approach , “John R. Dixon and CPoli” Field Stone Publishers, USA. ISBN: 9780964527201
5.	Material Selection in Mechanical Design , “M. F. Ashby”Elsevier. ISBN: 9780080419077

PE359 TOTAL LIFE CYCLE MANAGEMENT

1. Subject Code: PE359 Course	Title: Total Life Cycle Management
2. Contact Hours	: L: 3 T: 0 P: 0
3. Examination Duration (Hrs.)	: Theory: 3 Practical: 0
4. Relative Weight	: CWS: 25 PRS: 0 MTE:25 ETE:50 PRE: 0
5. Credits	: 3
6. Semester	: V
7. Subject Area	: OEC
8. Pre-requisite	: NIL
9. Objective	: To familiarize the students with the concept of Total Life Cycle, management of old vehicles, applying life cycle thinking to define tradeoffs. This course also introduces to sustainability, use of renewable resources.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Introduction : Definition of Total Life Cycle (TLC) – Concept of TLC - Life Cycle Impacts - Integrating Life Cycle Technologies- Products and Processes Within TLC - TLC Methodology- TLC Accessment Data to Complex Products – Resultant Improvement for Product	8
2	Vehicles End of Life : Design for End of Old Vehicle Management - Problems of Old Vehicles in Emerging Markets - Recovery and Economic Feasibility of Materials Such As Plastic, Rubber, Aluminium, Steel, etc.	8
3	Trade-offs : Applying Life Cycle Thinking to Define Tradeoffs Along the Supply, Manufacture - Use and End of Life Chain- Effects on the Customer - Expectation of the Customer -Evaluate Product Cost on Fuel Consumption, Emission, Durability, Environment and Health	10
4	Sustainability : What Is Sustainability - Use of Renewable Resources - View to Design Horizon.	8
5	Harmonization of Environmental Goals : TLC for Emerging Vs Developed Markets - Rules and Regulations to Guide Designers - International Common Practices for End of Life Vehicles.	8
Total		42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Life Cycle Management Case Study of an Instrument Panel /SAE, 1997/
2	Accident Reconstruction: Automobiles, Tractor-semitrailers, Motorcycles, and Pedestrians/Society of Automotive Engineers, 1987 /0898834546, 9780898834543.

PE361 TOTAL QUALITY MANAGEMENT

1. Subject Code: **PE-361** Course Title: **Total Quality Management**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0

4. Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To understand the philosophy and core values of Total Quality Management (TQM); determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization;

10. Details of Course:

Unit No.	Content	Contact Hours
1	Introduction to Quality- Definition of Quality- product, user, value, and manufacturing based perspectives, Dimensions of Quality, Quality Planning, Quality costs- optimization of quality costs, seven tools of quality control;Philosophies of Quality Gurus- Deming, Juran, Crosby, Feigenbaum, Ishikawa, Taguchi. Comparison of Quality Philosophies.	9
2	Statistical Process Control- Introduction to Quality characteristics-variables and attributes, Types and causes of variations, Control Charts for variables and attributes, Process capability.	8
3	Acceptance Sampling- Sampling process and lots formation; Advantages and applications of acceptance sampling; characteristics of O.C. Curve; Single, double, multiple, sequential sampling; ASN, ATI, AOQL, AOQ, AQL, LQL, Producer's and Consumer's risks.	7
4	Six Sigma and ISO 9000:2000- Principles of Six Sigma, Statistical basis, Tools and techniques, DMAIC principle, application of six sigma in manufacturing and service organizations, structure of ISO standards, Factors leading to ISO, Implementation and registration, Benefits of ISO.	6

5	Life Testing-Reliability -Life testing: objective, failure data analysis, MTTF, MTBF, hazard rate, exponential and Weibull models, system reliability-series, parallel and mixed configurations, Markov model.	6
6	Reliability Design and Allocation - Design for reliability, reliability improvement techniques, active redundancy and standby redundancy, K-out-of-N redundancy and maintenance policies.	6
Total		42

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1.	Evans JR,Lindsay WM, "The Management and Control of Quality", Cengage learning, India, ISBN-10: 8131501361, 2011
2	BediKanishka,"Quality Management",Oxford University Press India, ISBN-10: 0195677951, 2006
3	Besterfield,"Total Quality Management", Pearson Education, ISBN-10: 9332534454, 2015
4	Gryna FM, Chua RCH, Defeo JA, "Juran"s Quality Planning and Analysis for Enterprise Quality", McGraw Hill Education (India) Private Limited, ISBN-10: 0070618488, 2006

PT361 HIGH PERFORMANCE POLYMERS

- | | |
|--------------------------------|--|
| 1. Subject Code: PT361 | Course Title: High Performance Polymers |
| 2. Contact Hours | : L: 03 T: 00 P: 00 |
| 3. Examination Duration (Hrs.) | : Theory: 03 Practical: 00 |
| 4. Relative Weight | : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00 |
| 5. Credits | : 03 |
| 6. Semester | : V |
| 7. Subject Area | : OEC |
| 8. Pre-requisite | : NIL |

9. Objective : To impart knowledge about heat resistant polymers, liquid crystalline polymers, conducting and other special polymers.

10. Details of Course

S. No.	Contents	Contact Hours
1	Heat resistant polymers: Requirements for heat resistance, Determination of heat resistance, Synthesis, Structure-property relationships, Applications of heat resistant polymers like polyamides, polyimides and its derivatives, polyquinolines, polyquinoxalines, PBT, PBO, PBI, PPS, PPO, PEEK, engineering plastic blends.	9
2	Liquid crystalline polymers, Concept of liquid crystalline phase, Theories of liquid crystallinity, Characteristics of LC state and LCPs, Rheology of liquid crystalline polymers, Blends of LCPs, Self reinforced composites, Applications.	9
3	Conducting polymers, Conduction mechanism, semi-conductors and conducting polymers, Band theory, Doping of polymeric systems, Processing and testing of conducting polymers, Applications and recent advances in conducting polymers.	9
4	Synthesis and applications of photosensitive polymers, Curing reactions.	6
5	Polymers in specialty applications: Polymers in agricultural applications, Green houses, Mulches, Control release of agricultural chemicals, Seed coatings, Polymers in construction and building applications.	9
Total		42

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Encyclopedia of Polymer science and Engineering Vol.1-17/ J.I. Kroschwitz, 2007
2	Additive for coatings/ John Bieleman/ Wiley-VCH, 2000.
3	Fire Properties of Polymeric Composites Materials/ A.P. Mouritz, A G. Gibson/ Springer, 2006.

4	Modern Biopolymers science: Bridging the divide between fundamentals treatise and industrial application/S. Kasapis, I.T. Norton, J.B. Ubbink/ Elsevier 2009
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PT363 SEPARATION TECHNOLOGY

1. Subject Code: **PT363** Course Title: **Separation Technology**
2. Contact Hours : L: 03 T: 00 P: 00
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 03
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To familiarize students with various separation techniques.
10. Details of Course

Unit No.	Contents	Contact Hours
1	Separation factors and its dependence on process variables, classification and characterization, thermodynamic analysis and energy utilization, kinetics and mass transport, Theory of cascades and its applications.	7
2	Membrane Separations, Merits and demerits, Commercial, pilot plant polarization of membrane processes and laboratory membrane permeators, Dialysis, Reverse osmosis, Ultrafiltration, Membrane operations, Design controlling factors.	7
3	Separation by Sorption Techniques, Types and choice of adsorbents, chromatographic techniques, Retention theory mechanism, Design controlling factors, ion exchange chromatography equipment and commercial processes, recent advances in sorption technology.	7

5. Credits : 03
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To make student aware about the fundamentals and applications of non-conventional energy.

10. Details of Course

Unit No.	Contents	Contact Hours
1	Renewable and non-renewable energy sources, trends in energy consumption, Global and National scenarios, Prospects of renewable energy sources, Energy Management.	6
2	Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, measurement of solar radiation, flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, Storage of solar energy-thermal storage, Photo voltaics - solar cells & its applications.	6
3	Wind Energy: Basic system principles, Assessment of wind available, Design principles, Manufactured designs, Sizing and storage of energy, System efficiency, Overview of wind industry.	4
4	Energy from Biomass: Calorific value of Biomass samples, Pyrolysis, Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	6
5	Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages, and application of geothermal energy.	4

4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 03
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To impart knowledge about polymer waste and their management.

10. Details of Course

Unit No.	Contents	Contact Hours
1	Polymer and Plastics Waste: Definition of plastics waste and the associated problems, Identification, collection methods and separation. Integrated waste management – source reduction, recycling, energy recovering process through thermal and biological destruction, Land filling and composting.	8
2	Plastics waste management: Source reduction, reuse, repair, recycling, and incineration with examples. Plastics recycling: Classification, Code of practice, Primary, secondary, tertiary and quaternary recycling with examples, Waste plastics as fillers.	8
3	Recycling and degradation of plastics: Recycling and sustainability correlation, Basic principles and recovery, recycling and resource conservation.	9
4	Recycling of plastics by surface refurbishing, Application of a coating, polishing, Plastics, Environmental and Thermal ageing, Chemical degradation, Wear and erosion, Biodegradable plastics – an overview.	9
5	Environmental issues, policies and legislation in India.	8
Total		42

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Plastics Recycling – Products and Processes/ Ehrig (Ed.)/ Hanser Publication, 1993
2	Recycling and recovery of plastics/ Brandrup/ Hanser Publishers, New York, 1996
3	Handbook of Plastics Recycling/ By Francesco La Mantia/ Rapra Tech Ltd , 2002
4	Introduction to Plastics Recycling/ By Vanessa Goodship/ Rapra Tech Ltd ,2007

PT369 NANOTECHNOLOGY IN POLYMERS

1. Subject Code: **PT369** Course Title: **Nanotechnology in Polymers**
2. Contact Hours : L: 03 T: 00 P: 00
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 03
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To make student aware about the applications of nanopolymers in various fields.
10. Details of Course

S. No.	Contents	Contact Hours
1	Concepts of nanotechnology, Time and length scale in structures, Nanosystems, Dimensionality and size dependent phenomena, Surface to volume ratio-Fraction of surface atoms, Surface energy and surface stress, surface defects, Properties at nanoscale (optical, mechanical, electronic, and magnetic).	8
2	Nano-materials, Classification based on dimensionality, Quantum Dots, Wells and Wires, Carbon-based nano-materials, Metal based nano-materials, Nanocomposites, Nanopolymers, Nanoglasses, Nanoceramics, Biological nanomaterials.	8
3	Synthesis of nanopolymers, Chemical Methods, Metal Nanocrystals by Reduction, Solvothermal Synthesis, Photochemical Synthesis, Sonochemical Routes, Chemical Vapor Deposition, Metal Oxide - Chemical Vapor Deposition, Physical Methods such as ball Milling, electrodeposition, spray pyrolysis, flame pyrolysis, DC/RF magnetron sputtering, Molecular beam epitaxy.	9
4	Nanofabrication, Photolithography and its limitations, Electron beam lithography, Nanoimprint, Soft lithography patterning, Characterization with Field Emission Scanning Electron Microscopy, Environmental Scanning Electron Microscopy, High Resolution Transmission Electron Microscope, Scanning Tunneling Microscope, Surface enhanced Raman spectroscopy, X-ray Photoelectron Spectroscopy, Auger electron spectroscopy, Rutherford back scattering spectroscopy.	9
5	Applications of nanomaterials, Solar energy conversion and catalysis, Molecular electronics and printed electronics, Nanoelectronics, Polymers with aspecial architecture, Applications in displays and other devices, Nanomaterials for data storage, Photonics, Plasmonics, Nanomedicine, Nanobiotechnology and Nanotoxicology.	8
Total		42

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Organic and Inorganic Nanostructures/ Nabok/ Artech House, 2005.
2	Nanoscience: Nanotechnologies and Nanophysics/ Dupas, Houdy, Lahmani/ Springer-Verlag Berlin Heidelberg ,2007

3	Nanostructured Materials and Nanotechnology/ H.S. Nalwa/ Academic Press , 2002
4	A Textbook of Nanoscience and Nanotechnology/ Pradeep/ Tata McGraw Hill Education Pvt. Ltd. , 2012

PT371 APPLICATIONS OF POLYMER BLENDS AND COMPOSITE

1. Subject Code: **PT371** Course Title: **Applications of Polymer Blends and Composite**
2. Contact Hours : L: 03 T: 00 P: 00
3. Examination Duration (Hrs.) : Theory: 03 Practical: 00
4. Relative Weight : CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits : 03
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : NIL
9. Objective : To make student aware about the applications of polymers, blends and composites.
10. Details of Course

Unit No.	Contents	Contact Hours
1	Concepts of polymer blends, Advantages of blends over conventional polymers, Significance of polymer blend technology, Different steps involved in designing of a blend, Different methods of blending, Characterization of polymer blends.	8
2	Compatibilization and Phase Morphology, Role of compatibilizers in blend technology, techniques of compatibilization, Phase structure development in polymer blends, Factors affecting morphology of polymer blends, Properties of polymer blends.	8

3	Reinforcements, Properties and applications of Glass, Carbon, Kevlar, polyethylene, boron, ceramic and natural fibers. Concepts of matrix material, Thermoset matrix materials like - epoxy, polyester, vinyl esters, phenolic resin, polyimides, Thermoplastic matrix materials like - polyolefins, polyether ether ketones, polyphenylene sulfide, thermoplastic polyimides.	9
4	Concept of composites, particulate and fibrous composites, Properties of composites, Fabrication of continuous and short fiber composites and particulate composites, mechanical and physical properties	9
5	Applications of blends and composites for civil, aerospace, automobiles etc	8
Total		42

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Fibre Reinforced composites/ P. K. Malik/ Marcel Dekkar, 1988.
2	Composites Manufacturing: Materials, Product, and Process Engineering/ S.K. Mujumdar/ CRC press ,2002
3	Fibre-glass Reinforced Plastics/ N. P. Cheremisinoff (Ed)/ Noyce Pub, 1988.
4	Design Data for Reinforced Plastics/ N. L. Hancex, R. M. Mayer/ Chapman Hall, 1994.
5	Reinforced Plastics: Properties and Applications/ Raymond Seymour/ The Materials Information Society, 1991.

IT351 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

NAME OF DEPTT:

Information Technology

1. Subject Code: **IT351**

Course Title: **Artificial Intelligence and Machine Learning**

2. Contact Hours

: L: 3 T: 0 P: 0

3. Examination Duration (ETE)(Hrs.)

: Theory 3 Hrs Practical 0

4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Knowledge of discrete mathematics
9. Objective : The student should be able to understand the different supervised, unsupervised and reinforcement learning algorithms and choose the appropriate machine learning tool for different real world examples.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to Artificial Intelligence and Machine learning, State Space representation of problems, Concept of Search, overview of different tasks: classification, regression, clustering, control, Concept learning.	6
2.	Heuristic Search Techniques: Generate and Test, Hill Climbing, Best-first search, Branch and bound, A* algorithm, Game playing.	6
3.	Knowledge Representation: Propositional logic, Predicate Logic, semantic nets, frames	8
4.	Supervised Learning: Decision trees, nearest neighbors, linear classifiers and kernels, neural networks, linear regression; Support Vector Machines.	8
5.	Unsupervised Learning: Clustering, Expectation Maximization, Dimensionality Reduction, Feature Selection, PCA, factor analysis, manifold learning.	8
6.	Applications &Research Topics: Applications in the fields of web and data mining, text recognition, speech recognition	6
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Book		
1.	Artificial Intelligence by Elaine Rich, K. Knight, McGrawHill	2009
1.	Introduction to Machine Learning, Alpaydin, E., MIT Press, 2004	
2.	Machine Learning, Tom Mitchell, McGraw Hill, 1997.	1997
3.	Elements of Machine Learning, Pat Langley Morgan Kaufmann Publishers, Inc. 1995. ISBN 1-55860-301-8	1995
Reference Book		
4.	The elements of statistical learning, Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. Vol. 1. Springer, Berlin: Springer series in statistics, 2001.	2001
5.	Machine Learning: A probabilistic approach, by David Barber.	2006
6	Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006	2006

IT353 DATA STRUCTURES AND ALGORITHMS

NAME OF DEPTT:

Information Technology

- | | |
|--------------------------------------|---|
| 1. Subject Code: IT353 | Course Title: Data Structures and Algorithms |
| 2. Contact Hours | : L: 3 T: 0 P: 0 |
| 3. Examination Duration (ETE) (Hrs.) | : Theory 3 Hrs Practical 0 |
| 4. Relative Weightage | : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0 |
| 5. Credits | : 3 |
| 6. Semester | : ODD |
| 7. Subject Area | : OEC |

8. Pre-requisite : Nil
9. Objective : The objective of the course is to familiarize students with basic data structures and their use in fundamental algorithms.

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to C programming through Arrays, Stacks, Queues and Linked lists.	8
2.	Trees: Basic Terminology, Traversals, Binary search trees, optimal and average BST's. 2-4 trees, Applications of Binary search Trees, Complete Binary trees, Extended binary trees.	7
3.	Introduction to algorithms: Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Master's Theorem, Searching and Searching: Linear Search, Binary search, Insertion Sort, Quick sort, Merge sort, Heap sort, Radix Sort.	9
4.	Graphs: Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs, Breadth first search and connected components. Depth first search in directed and undirected graphs and strongly connected components.	8
5.	Spanning trees: Prim's and Kruskal's algorithm, union-find data structure. Dijkstra's algorithm for shortest paths, shortest path tree. Directed acyclic graphs: topological sort and longest path. Dynamic programming: Principles of dynamic programming. Applications: Matrix multiplication, Travelling salesman Problem.	10
Total		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books:		
1.	Horowitz and Sahni, "Fundamentals of Data structures", Galgotia publications	1983
2.	Tannenbaum, "Data Structures", PHI	2007(Fifth Impression)
3.	T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", 3 rd Ed., PHI.	2011 (reprint)
4.	E. Horowitz, S. Sahni, and S. Rajsekar, "Fundamentals of Computer Algorithms," Galgotia Publication	
Reference Books		
1.	R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI	2009(Fourth Impression)
2.	Aho ,Ullman "Principles of Algorithms "	

IT355 COMMUNICATION AND COMPUTING TECHNOLOGY

NAME OF DEPTT:

Information Technology

1. Subject Code: **IT355**

Course Title: **Communication and Computing Technology**

2. Contact Hours : L: 3 T: 0 P: 0

3. Examination Duration (ETE) (Hrs.) : Theory 3 Hrs Practical 0

4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0

5. Credits : 3

6. Semester : V

7. Subject Area : OEC

8. Pre-requisite : Operating systems, Algorithm Design and Analysis and data structures
9. Objective : To introduce the concept of Communications in Computer networks
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to Goals and Applications of Networks, Network structure and architecture, The TCP/IP reference model, services, Network Topology.	6
2.	Data Link Layer and Medium Access sub layer - Channel Allocations, LAN protocols -ALOHA protocols - Overview of IEEE standards - FDDI. - Elementary Data Link Protocols, Sliding Window protocols.	6
3.	Network Layer: Routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6 and Mobile IP.	8
4.	Transport Layer: Design issues, TCP and UDP, connection management, Congestion control, Leaky bucket, Token bucket algorithm. QoS.	8
5.	Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Internet and Public Networks, Firewalls	6
6.	Information and Web security: IP Security, Architecture, Authentication header, Encapsulating security payloads, combining security associations, Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Book		
1.	S. Tananbaum, "Computer Networks", 3rd Ed, PHI	1999

2.	U. Black, "Computer Networks-Protocols, Standards and Interfaces", PHI	1996
3.	W. Stallings, "Computer Communication Networks", PHI	1999
3.	Data Communications and Networking, Behrouz A. Forouzan 5/e	2013
Reference Book		
4.	William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersey.	2001
5.	Behrouz A. Forouzan, "Cryptography and Network Security", TMH.	2006

IT357 INTERNET AND WEB PROGRAMMING

NAME OF DEPTT: Information Technology

1. Subject Code : **IT357** Course Title: **Internet and Web Programming**

2. Contact Hours : L: 3 T: 0 P: 0

3. Examination Duration (ETE) (Hrs.) : Theory 3 Hrs Practical 0

4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0

5. Credits : 3

6. Semester : V

7. Subject Area : OEC

8. Pre-requisite : Nil

9. Objective : To introduce the concept of internet and web programming

10. Details of Course

S.No.	Contents	Contact Hours
1.	Internet and WWW: Internet basic, Introduction to internet and its applications, E- mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, domain name server, internet address World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), browsers - internet explorer, netscape navigator, opera, firefox, chrome, mozilla. Search engine, web saver - apache, IIS, proxy server, HTTP protocol.	6
2.	WEBSITES BASIC ANDWEB 2.0: Web 2.0: Basics-RIA Rich Internet Applications - Collaborations tools - Understanding websites and web servers: Understanding Internet – Difference between websites and web server- Internet technologies Overview – Understanding the difference between internet and intranet; HTML and CSS: HTML 5.0 , XHTML, CSS 3.	6
3.	E-MAIL SECURITY & FIREWALLS : PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls - Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions, intellectual property: copyright, patents, trademarks, cyber laws	8
4.	SERVELETS AND JSP: JSP Technology Introduction-JSP and Servelets- Running JSP Applications Basic JSP- JavaBeans Classes and JSP-Tag Libraries and Files- Support for the Model- View- Controller Paradigm- Case Study- Related Technologies.	8
5.	XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT	6
6.	PHP: Starting to script on server side, Arrays, function and forms, advance PHP, Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books		
1.	Internet and Web Technologies by Raj Kamal, Tata McGraw Hill edition. (ISBN: 9780070472969)	2002
2.	An Introduction to Search Engines and Web Navigation, Mark Levene, Pearson Education. (ISBN: 978047052684)	2010
3.	Modeling the Internet and the Web, Pierre Baldi, Paolo Frasconi, Padhraic Smyth, John Wiley and Sons Ltd. (ISBN: 978-0-470-84906-4)	2003
Reference Books		
4.	HTML: A Beginner's Guide by Wendy Willard, Tata McGraw-Hill (ISBN: 9780070677234)	2009
5.	PHP and MySQL for Dynamic Web Sites, Ullman, Larry, Peachpit Press.1 (ISBN: 978-0-321-78407-0)	2012

IT359 JAVA PROGRAMMING

NAME OF DEPTT:	Information Technology
1. Subject Code: IT359	Course Title: Java Programming
2. Contact Hours	: L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.)	: Theory 3 Hrs Practical 0
4. Relative Weightage	: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits	: 3
6. Semester	: V
7. Subject Area	: OEC
8. Pre-requisite	: Nil

9. Objective : To introduce the concept of java programming

10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to Java: Programming language Types and Paradigms, Computer Programming Hierarchy, How Computer Architecture Affects a Language? , Why Java?, Flavors of Java, Java Designing Goal, Role of Java Programmer in Industry, Features of Java Language, JVM –The heart of Java , Java’s Magic Byte code.	6
2.	The Java Environment: Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions. Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, Operators Assignments.	6
3.	Object Oriented Programming: Class Fundamentals , Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects , Constructor & initialization code block, Access Control, Modifiers, methods Nested , Inner Class &Anonymous Classes, Abstract Class & Interfaces Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion, Dealing with Static Members, Finalize() Method, Native Method.	8
4.	Extending Classes and Inheritance: Use and Benefits of Inheritance in OOP, Types of Inheritance in Java, Inheriting Data members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of “super”, Polymorphism in inheritance, Type Compatibility and Conversion Implementing interfaces.	8
5.	Package: Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages.	6
6.	GUI Programming: Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package) The Collection Framework: Collections of Objects, Collection Types, Sets , Sequence, Map, Understanding Hashing, Use of Array List & Vector.	8
TOTAL		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books		
1.	The Complete Reference Java,, Herbert Schildt, ISBN: 978-0-07163177-8, Publisher: McGraw Hill	7th Edition
2.	Thinking in Java, Bruce Eckel, ISBN: 0-13-187248-6, Publisher: Prentice Hall	4th Edition
3.	The Java Programming Languages,, Ken Arnold, ISBN-13: 978-032134980, Publisher: Sun	4th Edition,
4.	Java in Nutshell,, Benjamin,ISBN: 9781449371296, Publisher: O'Reilly Media, Inc.	6th Edition

1. Subject Code: **CE351** Course Title: **Geoinformatics and its Applications**
2. Contact Hours : L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.) : Theory 3 Hrs Practical 0
4. Relative Weightage : CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits : 3
6. Semester : V
7. Subject Area : OEC
8. Pre-requisite : Nil
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engineering and allied fields.

10. Details of Course

S. No.	Contents	Contact Hours
1	Introduction to Geoinformatics, Remote Sensing, GIS and GPS: Definitions of Geoinformatics, Remote Sensing, GIS and GPS, sources of energy, electromagnetic spectrum, electromagnetic radiation, reflection, transmission and absorption, Platforms and sensors, active and passive sensors, PAN, Multi and hyperspectral remote sensing data acquisition systems	8
2	Maps, Datums, Projections Systems and spatial data analysis - Plane and Geodetic surveying, Classification of surveys, Basic Principles of Surveying, Type of maps, scales and uses, plotting accuracy, map sheet numbering. Datums, coordinates and map projection systems. Data retrieval and querying, measurements in GIS, classification, accuracy.	8
3	Optical, Thermal and Microwave Remote Sensing. Brief review of Optical, thermal and microwave remote sensing, their utility, merit and demerits, Interaction of EMR with atmosphere, scattering, refraction, absorption, transmission, atmospheric windows, interaction of EMR with earth surface, spectral characteristics of remote sensing data,	8
4	Basic Photogrammetry and Digital Image Processing: Photogrammetry, aerial and terrestrial, applications of photogrammetry, types and geometry of aerial photograph, flying height and scale, relief (elevation) displacement. Digital image, digital image processing introduction to, preprocessing, enhancement, classification, visual image interpretation, Introduction to software - MATLAB, ENVI, ERDAS, AutoCAD etc	10
5	Applications of Geoinformatics, Remote Sensing, GIS and GPS: Land cover classification survey and Mapping, Digital elevation model (DEM), Introduction to SAR data, Applications in Disaster management, geology, forest security and military projects.	8
Total		42

11. Suggested Books:

S.N.	Name of Books/ Authors	
1	Agarwal, C.S. and Garg, P.K., "Remote Sensing in Natural Resources Monitoring and Management", Wheeler Publishing House(ISBN 6-74-268173-4)	2000
2	Bossler, J.D., "Manual of Geospatial Science and Technology", Taylor and Francis. (ISBN 0-74-68914355-7)	2002
3	Burrough, P.A. and McDonnell, R.A., "Principles of Geographic Information System", Oxford University Press. (ISBN 0-07-985256-4)	2000
4	Chandra, A.M. and Ghosh, S.K., "Remote Sensing and Geographical Information Systems", Alpha Science. (ISBN 0-07-8452567-1)	2005
5	Gopi, S., "Global Positioning System: Principles and Applications", Tata McGraw Hill. (ISBN 0-07-7691528-1)	2005



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