



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
CIVIL ENGINEERING

W.E.F 2015

DEPARTMENT OF CIVIL ENGINEERING

Scheme of Teaching and Examinations B. Tech. (Civil Engineering) W.E.F. 2015



DELHI TECHNOLOGICAL UNIVERSITY
(Formerly Delhi College of Engineering)

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Delhi Technological University

(Formerly Delhi College of Engineering)

Shahbad Daulatpur, 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 CIVIL ENGINEERING

VISION

- To produce globally relevant civil engineers through a rigorous curriculum and a conducive teaching – learning environment.
- Creation of knowledge and innovations with the support of qualified faculty having a strong interface with the industry and R&D organizations.

MISSION

- To produce civil engineers to meet the current and future requirement of the industry in India and abroad.
- To equip with cutting-edge technology and training to provide solution to the industry.
- To engage into technologically relevant activities including extension programs for capacity development in thrust areas.

PROGRAM EDUCATIONAL OBJECTIVES(PEOS)

- PEO 1:** To achieve high level of technical expertise to understand, identify, formulate, design and implement a real life civil engineering problem.
- PEO 2:** To inculcate the value based leadership and ethical qualities in implementing the civil engineering projects.
- PEO 3:** To enhance the need based active participation in infrastructural development for the betterment of society.
- PEO 4:** To foster qualities for life-long learning, working with team spirit with effective communication and powerful interaction with society.

DEPARTMENT OF CIVIL ENGINEERING
BACHELOR OF TECHNOLOGY (CIVIL 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 (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	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.	EC251	Basic Electronics & Instrumentation	AEC	4	3	0	2	3	0	15	15	30	40	-
2.	CE201	Civil Engg. Basics and Applications	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	CE203	Engineering Mechanics	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CE205	Fluid Mechanics	DCC	4	3	0	2	3	0	15	15	30	40	-
5.	CE207	Engineering Analysis and Design	DCC	4	3	1	0	3	0	25	-	25	50	-
6.	MG203	Fundamentals of Management	HMC	3	3	0	0	3	0	25	-	25	50	-
		Total		23	18	1	8							

II Year: Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	EN252	Environmental Engineering	AEC	4	3	0	2	3	0	15	15	30	40	-
2.	CE202	Mechanics of solids	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	CE204	Engineering Survey	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CE206	Soil Mechanics	DCC	4	3	0	2	3	0	15	15	30	40	-
5.	CE208	Hydraulics & Hydraulic Machines	DCC	4	3	0	2	3	0	15	15	30	40	-
6.	HU202	Engineering Economics	HMC	3	3	0	0	3	0	25	-	25	50	-
		Total		23	18	0	10							

III Year: Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	CE301	Analysis of Determinate Structures	DCC	4	3	0	2	3	0	15	15	30	40	-
2.	CE303	Design of RCC structures	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	CE3xx	Departmental Elective Course-1	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	30 /25	40/ 50	-
4.	CE3xx	Departmental Elective Course-2	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	30 /25	40/ 50	-
5.	UExxx	Open Elective Course	OEC	3	3	0	0	3	0	25	-	25	50	-
6.	HU301	Technical Communication	HMC	2	2	0	0	3	0	25	-	25	50	-
		Total		21	17									

III Year: Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	CE302	Analysis of Indeterminate Structures	DCC	4	3	1	0	3	0	25	-	25	50	-
2.	CE304	Geotechnical Engineering	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	CE306	Transportation Engineering	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CE3xx	Departmental Elective Course-3	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	30 /25	40/ 50	-
5.	CE3xx	Departmental Elective Course-4	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	30 /25	40/ 50	-
6.	HU304	Professional Ethics and Human values	HMC	2	2	0	2/0	3	0	25	-	25	50	-
7.		Total		22										

IV Year: Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	CE401	B.Tech. Project-I	DCC	4										
2.	CE403	Training Seminar	DCC	2										
3.	CE405	Design of Steel Structures	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	CE407	Water Resources Engineering	DCC	4	3	0	2	3	0	15	15	30	40	-
5.	CE4xx	Departmental Elective Course-5	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	30/ 25	40/ 50	-
6.	CE4xx	Departmental Elective Course-6	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	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.	CE402	B.Tech. Project-II	DCC	8										
2.	CE404	Construction Technology & Management	DCC	4	3	1	0	3	0	25	-	25	50	-
3.	CE4xx	Departmental Elective Course-7	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	30/ 25	40/ 50	-
4.	CE4xx	Departmental Elective Course-8	DEC/ GEC	4	3	0/1	2/0	3	0	15/ 25	15/0	30/ 25	40/ 50	-
		Total		20										

List of Departmental Elective Courses

S. No.	Elective Code	Title of Elective	Elective no.
1.	CE305	Mechanics of Materials	DEC-1
2.	CE307	Advanced geo-technical engineering	
3.	CE309	Environmental Engineering Design	
4.	CE311	Photogrammetry and astronomy	
5.	CE313	Earthquake Technology	DEC-2
6.	CE315	Rock engineering	
7.	CE317	Solid Waste Management & Air Pollution Control	
8.	CE319	Application of geo-informatics remote sensing and GIS in engineering	
9.	CE308	Disaster Management	DEC-3
10.	CE310	Geo-technical processes	
11.	CE312	Water Power Systems & Design	
12.	CE314	Tunnel, ports and harbor engineering	DEC-4
13.	CE316	Matrix methods of structural analysis	
14.	CE318	Analysis & Design of Underground Structures	
15.	CE320	Computational Hydraulics	
16.	CE322	Traffic and transportation planning	
17.	CE409	Advanced design of concrete structures	DEC-5
18.	CE411	Interaction behavior of soil structure	
19.	CE413	Water Resources Management	
20.	CE415	Transportation safety and environment	

21.	CE417	Finite element method for 2-D structures	DEC-6
22.	CE419	Soil Dynamics	
23.	CE421	Hydraulic structures and flood control works	
24.	CE423	Advanced transportation engineering	
25.	CE406	Advanced design of steel structures	DEC-7
26.	CE408	Computational Geo-mechanics	
27.	CE410	Advanced Fluid Mechanics	
28.	CE412	Construction and design aspects in transportation engineering	
29.	CE414	Design of bridges	DEC-8
30.	CE416	Geo-environmental and geo-hazard engineering	
31.	CE418	Ground water and seepage	
32.	CE420	Traffic Engineering	

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 Planck'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: **Introduction to 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

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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, Eigenvalues 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

1. Subject Code: **EC 251** Course Title: **Basic Electronics & Instrumentation**
2. Contact Hours : L: 3 T: 0 P: 2
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits : 4
6. Semester : III
7. Subject Area : AEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts basic electronics & instrumentation.
10. Details of Course :

S. No.	Contents	Contact Hours
1	<p>Introduction to semiconductor physics : Classification of materials (conductors, insulators and semiconductors) intrinsic and extrinsic semiconductor, drift and diffusion currents, p-n junction diode: Physical operation, diode current equation and I-V characteristic and piecewise linear model, concept of load line, breakdown in p-n diode, Zener diode</p> <p>Diode Applications: Rectifier Zener regulators, clipping and clamping circuits.</p>	07
2	<p>Bipolar Junction Transistor: Physical structure and modes of operation. BJT current components, BJT characteristics, large-signal equivalent circuit and concept of load line, small signal equivalent, Basic single-stage BJT amplifiers (CE, CB, CC) and frequency response of an RC coupled amplifier. JFET/ MOSFET characteristics and amplifiers</p>	08

3	Concept of positive and negative feedback, merits and demerits of negative feedback, Principle of oscillation, LC and RC oscillators. Power Amplifiers (Class A and Class B), Operational Amplifier and basic applications. Operation Amplifiers: Ideal characteristics, basic applications: Inverting and Non-inverting amplifier, Integrator, Differentiator, Voltage follower, Summing and Difference Circuits	08
4	Introduction to Digital Circuits: Boolean Algebra, Logic gates, minimization of switching function, Karnaugh map method, Binary adder, subtractor, multiplexer and decoder. Flip-flop, counter. Shift registers	06
5	Electronic Measurements: Electronic voltmeter, multimeter. Differential voltmeters, time, frequency and phase angle measurements using CRO, Digital voltmeter, multimeter and storage oscilloscope.	06
6	Instrumentation: Transducers, strain gauges, inductive & capacitive transducers, piezoelectric and Hall-effect transducers, thermistors, thermocouples, photo-diodes & photo-transistors, signal conditioning and telemetry, basic concepts of smart sensors and application	07
Total		42

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1.	Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky, Pearson.	2005
2.	Electronics analog and digital by I.J. Nagrath	2008
3.	Modern digital electronics by R.P. Jain (TMH)	2012
4.	Measurements and Instrumentation by A.K. Sawhney; Dhanpatrai & sons	2004

10. Details of Course

:

S. No.	Contents	Contact Hours
1	Fundamental concepts: System of units, scalar and vector quantities, characteristic of force, fundamental laws of mechanics, system of forces, two force systems, three force system, equilibrium of a body, equilibrium equations for plane force and space force system	5
2	Co-planar concurrent forces: Composition of force, resolution of forces, concurrent and non concurrent forces, non concurrent force, couple, moment, Varignon's theorem, resultant of coplanar force systems and reaction of supports.	5
3	Analysis of pin jointed frames: Perfect, deficient and redundant frames, method of Joints, method of sections, tension co-efficient method and graphical method for plane and space frames.	7
4	Friction and lifting machines: Law of friction, angle of friction, angle of repose and cone of friction, wedges, law of machines, mechanical advantage and velocity ratio, efficiency, self-locking and reversibility of machines, pulley, wheel and axle.	7
5	Centroid and moment of inertia: Centre of gravity, Theorem of Pappus and Guldinus, moment of inertia, parallel axis theorem, polar moment of inertia, radius of gyration and moment of inertia of composite sections, mass moment of inertia and product moment of inertia.	8
6	Kinematics and kinetic: Rectilinear and curvilinear motion, projectile, relative motion, kinetics of particle, Newton's laws, work, energy and power, conservation of energy, impulse and momentum, impact.	8
Total		40

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Rajshekharan & Sankarsubramanian, 'Computational Structural Mechanics', Prentice Hall of India, (ISBN 978-81-203-1734-3)	2007

5	Laminar and turbulent flow in pipe: Laminar flow through pipes, velocity distribution, turbulent flow, Reynolds equation, prandtl's mixing length theory, velocity distribution in pipe flow and plate flow, Darcy's weisbach equation, friction factor, water hammer.	7
6	Dimensional analysis and models: Dimensional homogeneity, Rankines and Buckingham'a pie theorem, dimensionless numbers, Types of models and model analysis.	5
7	Boundary layer theory: Concept of boundary layer, laminar and turbulent boundary layers, boundary layer thickness, laminar sub-layer, hydrodynamically smooth and rough boundaries, cavitations.	6
8	Drag and lift: Forces exerted by flowing fluid on rest body, drag and lift, streamlined body and bluff body, skin friction, drag on sphere, cylinder and flat plate.	4
Total		41

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Bansal, R.K. "Fluid Mechanics and hydraulics machines", Laxmi Publications(P) Ltd. (ISBN 81 7008 311 7)	2008
2	Garde, R.J. and Mirajgaoker, A.G. "Engineering fluid Mechanics", Nem Chand & Bros. (ISBN 81 88429 01 5)	2000
3	Som, S.K. and Biswas, G., "Fluid Mechnics" Tata pMcGraw Hill. (ISBN 21 345 24561)	2004
4	Kumar, K.L., "Engineering fluid Mechanics", Eurasia Publishing House (P) LTD. (ISBN 81 219 0100 6)	2000
5	Ojha, C.S.P., "Fluid Mechanics and Machinery, OXFORD, University Press. (ISBN 01 19 569963 7)	2010
6	Rajput, R. K., "Fluid Mechanic", S. CHAND & COMPANY LTD. (ISBN 81 219 1667 4)	2004

7. Subject Area : HMC
8. Pre-requisite : NIL
9. Objective : The basic objective of this paper is to acquaint the students with the basic concepts of management necessary to deal with emerging business environment besides sensitizing them about societal challenges.
10. Details of Course :

S.No.	Detail Contents	Contact Hrs.
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 Vs sales, 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
1.	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011(ISBN:9780273755869)

10. Details of Course

:

S. No.	Contents	Contact Hours
1	UNIT I:- Water demand, domestic, industrial and municipal, variations in demand. Population forecasting. Physical, Chemical and Microbiological quality parameters. Drinking water quality criteria and standards. Surface, subsurface, selection and development of sources. Quality of sources and their treatment requirements. Design of the component of water distribution systems. Leakage and control, Conveyance: Pipes and conduits for water, rising main, types and capacity of pumps, pipe joints, specials, fittings and valves.	8
2	UNIT II:- Coagulation, common coagulants and coagulant aids and their reactions. Mixing and flocculation basin design. Sedimentation, design principles, discrete and flocculation suspensions, sedimentation tank details. Maintenance treatment unit, Filtration, gravity and pressure filters, single and multimedia filters. Water softening by chemical precipitation and ion exchange. Aeration of water to remove iron and manganese and taste and odour. Disinfectants, chlorination of water supplies.	8
3	UNIT III: Wastewater sources and flow rates, domestic, industrial and municipal, variations in flow. Hydraulics of storm sewers, sewer appurtenances. Design of Wastewater collection system. Physical, Chemical and Microbiological characteristics of waste water. Effluent disposal and re-use, surface disposal, Disposal into rivers, self purification, oxygen sag curve, regulations for disposal into sewer/land/stream/sea.	8
4	UNIT IV: Physical Treatment, screening, activated sludge, trickling filter, septic tanks, anaerobic sludge digestion, stabilization ponds and aerated lagoons.	8
5	UNIT V: Solid waste management, sources and composition. Principal industrial and hazardous solid waste, collection, characteristics and disposal. Major air pollutants, sources and effects, measurement of air quality, criteria and standards, Atmospheric cleansing processes (Natural). Noise pollution standards effects and abatement.	8
Total		40

10. Details of Course :

S. No.	Contents	Contact Hours
1	Review of basic concepts in mechanics, classification of materials, introduction to tensors, their representation, study of kinematics : Motion field, displacement field, strain measures, principal strains, transformation of strains, compatibility conditions, concept of traction, Cauchy's stress theorem, traction on arbitrary planes, extreme normal and shear traction, octahedral shear stress	8
2	Equilibrium equations in Cartesian and cylindrical polar coordinates, constitutive relations: restrictions on constitutive relations, general relationship between cauchy's stress and Cauchy green strain for isotropic materials, generalised Hooke's law and its reduction for isotropic and orthotropic materials	8
3	Formation of boundary value problems: displacement method, stress method, Airy stress functions for plane stress and strain problems, uniaxial tension, thick walled annular cylinder subjected to uniform boundary pressure, infinite medium with a stress free hole under far field tension loading	8
4	Bending of prismatic straight beams: pure bending, bending due to uniform transverse loading and bending due to transverse sinusoidal loading of a beam, asymmetrical bending of straight beams, shear center, shear stresses in thin walled open sections, torsion of circular and other sections	8
5	Pure bending of curved beams, curved cantilever under end loading, derivation of beam bending equation for pure bending of beams, beams on elastic foundations Appropriate experiments would be taken up.	8
Total		40

11. Suggested Books

S.N.	Name of Books/ Authors	Year of Publication
1.	Popov E.P., 'Engineering Mechanics of Solids', Prentice Hall of India Pvt. Ltd., (ISBN-81-213-2139-4)	1997

3	Chain, Compass and Plane Table Surveys : Chain survey procedures, errors and corrections, planning and carrying out chain survey. Compass survey, types of compass and various terms related to magnetic compass, computing and plotting a traverse. Plane table surveys and mapping	6
4	Leveling, Triangulation and Trilateration and Contouring: Leveling and measurement of elevations, different methods of leveling. Methods of control establishment, traversing, triangulation, trilateration, computation of coordinates, trigonometrical leveling, theodolite surveying and tachometry, contouring, Curves: curve layout, horizontal, transition and vertical curves.	8
5	Project Surveys, Hydrographic Survey, Astronomy and Map making in India: General requirement and specifications of Engineering project surveys, Reconnaissance, Principles and practices, construction surveys, location and layout surveys. Hydrographic survey, shoreline, tidal and river surveys, soundings in hydrographic survey, Terms in astronomical survey, basics of spherical trigonometry. Map in the making-survey of India publication, conventional symbol charts and different types of maps. Appropriate experiments would be taken up.	6
Total		32

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of publication
1	Agor, R, "Surveying", Vol. II & III, Khanna Publications, Delhi (ISBN 89-24-0594-7)	2000
2	Arora, K. R., "Surveying", Vol. II & III, Standard Book House, Delhi (ISBN 644-23-0774-4)	1999
3	Bannister, A. and Baker, R., "Solving Problems in Surveying", Longman Scientific Technical, U. K. (ISBN 19-45-2494-7)	2000
4	Kennie, T. J.M. and Petrie, G., "Engineering Surveying Technology", Blackie & Sons Ltd, London. (ISBN 39-12-6050-8)	1998
5	Punmia, B. C., "Surveying", Vol. II & III, Laxmi Publications, New Delhi (ISBN 69-85-0743-2)	2000

3	Seepage: Laplace's equation for simple flow problems, Flow nets, Seepage calculation from flow nets, Flow nets in anisotropic soil, Seepage pressure, Uplift pressure, Seepage through earth dams, Exit gradient, Piping, Criteria for design of filters. Compaction: General principals, Laboratory determination, Factors affecting compaction, Field compaction, Compaction of cohesionless and cohesive soils, Field control of compaction.	8
4	Stress Distribution: Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb; Newmark's influence chart, contact pressure. Shear Strength: Introduction, Mohr's circle of stress, Mohr-Coulomb failure theory, Shear strength parameters, Various Laboratory tests for measurement of shear strength, UU, CU and CD tests and their relevance to field problems, Plotting of test data, Shear strength characteristics of Normally consolidated and over consolidated clays, shear strength characteristics of sands.	8
5	Compressibility and Consolidation: Importance of compressibility, Effect of soil type, stress history and effective stress on compressibility, Factors affecting consolidation and compressibility, Normally consolidated and over consolidated soils, Void ratio-pressure relationship, Coefficient of compressibility and Volume change, Mechanism of consolidation, Terzaghi's theory of consolidation, Laboratory consolidation tests and analysis of data, Determination of Coefficient of Consolidation.	10
Total		40

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of publication
1.	Basic and applied soil mechanics by Gopalranjan and Rao, ASR (revised edition), New Age International, New Delhi. (ISBN 785-45-7080-1)	1995
2.	Introduction to geotechnical engineering by Holtz R and Kovacs, WD, John Wiley New York. (ISBN 63-77-7894-5)	2007
3.	Soil Mechanics: TW Lambe and RV Whitman, John Wiley New York. (ISBN 85-17-0454-7)	2004

3	Gradually varied flows: Differential equation of GVF, Different types of flow profiles, Flow controls.	6
4	Rapidly varied flows: Hydraulic jump in different types of channels, properties of jumps. Broad crested weirs, sharp-crested weir, ogee spillway, sluice gate flow and critical depth flumes & their applications.	6
5	Hydraulic Turbines: Introduction, Dynamics forces on curved and bends, Elements of hydroelectric power plants, head and efficiencies of hydraulic turbines, classification of turbines, Pelton wheel turbine, working proportions of Pelton wheel, Design of Pelton wheel runner, study and design of Francis turbine, Draft tube theory, Cavitation, Kaplan turbine, working proportions of Kaplan turbine, Efficiency, specific speed, unit quantities and velocity triangles.	10
6	Hydraulic Pumps: centrifugal pumps, types, performance parameters, scaling, pumps in parallel; reciprocating pumps air vessels, performance parameters; and hydraulic ram. Appropriate experiments would be taken up.	6
TOTAL		41

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Bansal, R.K. "Fluid Mechanics and hydraulics machines", Laxmi Publications(P) Ltd. (ISBN 81 7008 311 7)	2008
2	Subramanya, K., "Theory And Application of Fluid mechanics including Hydraulic Machines", TMH New Delhi (ISBN 0-07-460369-8)	1997
3	Subramanya, K., "Flow in Open Channels", TMH New Delhi. (ISBN 0-07-462446-6)	2006
4	Srivastava Rajesh," Flow Through Open Channels", Oxford University Press. (ISBN-10-019-569038-9)	2008
5	Garde, R.J. "Fluid Mechanics Through Problems", New Age International (P) Limited, Publishers (ISBN 81-224-1131-2)	1997
6	Ojha, C.S.P., "Fluid Mechanics and Machinery, OXFORD, University Press. (ISBN 10: 19 569963-7)	2010

1. Subject Code: **HU202** Course Title: **Engineering Economics**
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 : IV
7. Subject Area : HMC
8. Pre-requisite : NIL
9. Objective : To enable the students to understand the economic theories which may be applied to maximize return and economic environment in which they have to operate.
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

4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits : 4
6. Semester : V
7. Subject Area : DCC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

S. No.	Contents	Contact Hours
1	Classification of Structures, Stress Resultants, Degree of Freedom per node, Static and Kinematic degrees of indeterminacy. Work and Energy. Strain energy of deformable systems, Betti's theorem of reciprocal work and Maxwell's theorem. Principle of virtual work and complementary virtual work, Principle of total minimum stationary potential energy, Stable and unstable equilibrium, Castigliano's Theorem I and II.	10
2	Analysis of determinate beams and plane frames. BM, SF and Axial thrust diagrams, Rolling loads, Influence lines diagrams Reaction, SF, BM, for determinate beams. Floor beams. ILD for Slope and Deflections in simple beams.	8
3	Classification of pin jointed determinate trusses. Analysis of plane, complex, compound and simple space trusses. Method of tension coefficient, graphical method of substitution. Maxwell's diagram to analyse simple trusses.	8
4	Deflection due to bending: The moment curvature relation, Macaulay's method, Moment area and Conjugate beam method, Deflection of determinate plane frames using strain energy and unit load method, Elastic curve sketch).	8

5	Analysis of arches: Linear arch, Eddy's theorem, three hinged parabolic arch, Spandrel braced arch. Influence line diagrams for Horizontal thrust, BM RSF,NT. Stability of Columns: Study of ideal rigid columns,two bar and three bar systems. Euler's formula for long columns, Columns with eccentric axial loads, Rankine's formula. Appropriate experiments would be taken up.	10
Total		44

11. Suggested Books:

S. No.	Name of Books/ Authors	Year of Publication
1.	Theory of Structures, Stephen P. Timoshenko and D. H. Young McGraw-Hill international book editions (ISBN 10: 0070648689 ISBN 13: 9780070648685)	1965
2.	Structural Analysis a unified classical and matrix approach, A.Ghali, A M Neville and T G Brown, SPON PRESS (In India by Replika Press Pvt. Ltd.) (ISBN 13-978-0-415-28092-1)	2003
3.	Intermediate Structural Analysis, C K Wang,Tata McGraw-Hill Education Pvt. Ltd., 2014 ISBN 10: <u>0070702497</u> / ISBN 13: <u>9780070702493</u>	2014
4.	Elementary Structural Analysis, J B Wilbur, C H Norris, S Utku, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN 0-07-058116-9	2003
5.	Strength of Materials, Vol. I: Elementary Theory and Problems Paperback – 2004 ,S. TimoshenkoCBS Publishers & Distributors Pvt. Ltd., New Delhi	2004
6.	Strength Of Materials,3E, Vol II Timoshenko S.CBS Publishers & Distributors Pvt. Ltd., New Delhi (2002) ISBN 10: 8123910770 ISBN 13 : 9788123910772	2002
7.	Mechanics of Materials 8th Edition by James M. Gere and Stephen P. TimoshenkoCBS Publishers Pvt. Ltd., New Delhi (2004)ISBN 10: 8123908946 ISBN 13: 978812390894	2004

10. Details of Course :

SI 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 Ethics Engineering 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 Reference:

S.N.	Name of Books/ Authors	Year of Publication
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 ISBN978-0-07-248311-6	2010
5.	Gopi, S., "Global Positioning System: Principles and Applications", Tata McGraw Hill. (ISBN 0-07-7691528-1)	2005

1. Subject Code: **CE 302** Course Title: **Analysis of Indeterminate Structures**
2. Contact Hours : L: 3 T: 1 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 : 4
6. Semester : VI
7. Subject Area : DCC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course :

S. No.	Contents	Contact Hours
1	Theorem of Least work, Concepts of Symmetry. Analysis of fixed beams, continuous beams, simple rigid and pin jointed indeterminate frames using method of consistent deformation, strain energy methods. Müller Breslaü principle and its application in drawing influence lines for indeterminate beams.	10
2	Analysis of continuous beams, simple frames with and without translation of joints using slope deflection method and moment distribution method. Analysis of symmetric structures.	10
3	Flexibility and stiffness matrix method of analysis of beams, rigid and pin jointed plane frames.	8
4	Analysis of two hinged arches. Influence line diagrams for BM, SF and thrust in two hinged arches. Analysis of cables with concentrated and continuous loading. Basics of Suspension bridges with two and three hinged stiffening girders. Influence line diagrams for BM SF in stiffening girders.	8

5	Basics of plastic analysis. Theorems of plastic collapse. Plastic analysis of beams, plane frames using statical and mechanism methods. Minimum weight design methods.	8
Total		44

11. Suggested Reference:

S.N.	Name of Books/ Authors	Year of Publication
1.	Theory of Structures, Stephen P. Timoshenko and D. H. Young McGraw-Hill international book editions (ISBN 10: 0070648689 ISBN 13: 9780070648685)	1965
2.	Structural Analysis a unified classical and matrix approach, A.Ghali, A M Neville and T G Brown, SPON PRESS (In India by Replika Press Pvt. Ltd.) (ISBN 13-978-0-415-28092-1)	2003
3.	Matrix analysis of framed Structures, W Weaver Jr and J M Gere, CBS Publishers Delhi . (ISBN 10: 8123911513 ISBN 13: 9788123911519)	2004
4.	Intermediate Structural Analysis, C K Wang,Tata McGraw-Hill Education Pvt. Ltd., 2014 ISBN 10: <u>0070702497</u> / ISBN 13: <u>9780070702493</u>	2014
5.	Indeterminate Structural Analysis, J S Kinney, Addison-Wesley Educational Publishers Inc, 1957 ISBN 10: 0201036959 ISBN 13: 9780201036954	1957
6.	Elementary Structural Analysis, J B Wilbur, C H Norris, S Utku, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN 0-07-058116-9	2003
7.	Computer Methods of Structural Analysis, BEAUFIT, F.W., ROWAN, W.H., Jr., HOADLEY P.G. and HACKETT R.M., Computer Methods of Structural Analysis, Prentice-Hall, Inc. Englewood Cliffs; New Jersey, 1970.	1970
8.	Plastic design of Frame Vol I, Sir J Baker & J Heyman, Cambridge University Press (1969) ISBN 10: 0521075173 ISBN 13: 9780521075176	1969

10. Details of Course

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S. No.	Contents	Contact Hours
1	Soil Exploration: Purpose; Planning and reconnaissance; Various methods; Bore holes and depth of exploration; Sampling and samplers; Standard penetration test; Correlations between penetration resistance and strength parameters; Static cone test; Dynamic cone test; Plate Load test; Interpretation of test results; Indirect methods of soil exploration.	6
2	Earth Pressures and Retaining Structures: Lateral earth pressure problems; Plastic equilibrium in soils, active and passive states; Earth pressure at rest; Rankine's theory of active and passive earth pressures; Active and passive earth pressure of cohesive soils; Coulomb's earth pressure theory; Graphical constructions to evaluate earth pressures; effect of surcharge and earthquake loading; earth pressure due to inclined backfills; Stability Analysis of retaining walls, choice of backfill material and importance of drainage; Bracings for open cuts, recommended design diagrams of earth pressure for typical soils; Earth pressure on cantilever and anchored sheet pile walls; Arching and its practical implications.	8
3	Stability of Slopes: Factor of safety; Stability of infinite slopes; Stability of finite slopes; The Swedish circle method; Bishop's simplified method; Friction circle method; Taylor's stability number; Acceptable values of factor of safety; Critical conditions for the stability of earth dams; Road and earth dam embankments; Modes of failure and the usual protective measures; Slope inclinations usually adopted.	8
4	Shallow Foundations: Common types with illustrations of situations where each one of them is adopted; Terminology; Rankine's analysis; Terzaghi's bearing capacity theory; Types of failures; Bearing capacity computations in cohesionless and cohesive soils; General bearing capacity equation, Meyerhof's analysis, Effect of water table on bearing capacity; Bearing capacity on layered soil; Use of field test data; Foundation settlements; Components and limits of settlements'; Estimation of settlement of footings / rafts by using field and laboratory test data; Corrections for rigidity and 3-dimensional consolidation effects. Pile Foundations: Classification and uses of piles; Selection and installation of piles; Load carrying capacity of piles, dynamic and static formulae; Single pile and group actions; Pile load tests; Negative skin friction, Settlement of pile groups; Laterally loaded piles.	8

6. Semester : VI
7. Subject Area : DCC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

Sl. No.	Contents	Contact Hours
1	Introduction: Role of Transportation, Modes of Transportation, their importance and limitations. Planning and Engineering surveys. Basic requirements of alignment. Controlling factors for alignment.	8
2	Highways: Geometric design of highways, highway materials, highway construction, design of highway pavements, traffic studies, traffic control devices, highway drainage and maintenance.	8
3	Railways: Elements of Permanent way, wear and creep of rails, geometric design, track resistance and tractive power, points and crossings, design of turnout, stations and yards, signaling and interlocking, modernization of railways.	8
4	Airports: Classification of airports, obstruction and zoning laws, typical layout of airport, design of runway, design of taxiway, airport marking and lighting, air traffic control.	8
5	Tunnel, harbor and docks: Types of tunneling, methods of tunneling, classification of harbors, breakwaters, types of docks and their merits and demerits.	8
Total		40

2.	Communication at the Workplace: Oral and Written: A. Written Communication- Letters, Orders (Sale/Purchase) Report Writing, Technical proposals Resume, SOP, Memo, Notice, Agenda, Minutes, Note Taking/Making, B. Oral Communication: Seminars, Conferences, Meetings, Office Etiquettes/ Netiquettes, Presenting Written Material Negotiation, Demonstration, Group Discussion, Interview	6 6
3.	Group Discussion and Report Writing: i) Group Discussion (Continuous assessment through the semester) ii) Minor Report Writing(to be submitted before Mid-Semester Examination) iii) Major Report writing (To be submitted before End Semester Examination)	13
Total		28

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
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
5	The Essence of Effective Communication, Ludlow, Ron and Fergus Panton. Prentice Hall: PHI. ISBN-81-203-0909-X	1996
6	Advanced Technical Communication, Gupta, Ruby. Foundation Books, CUP. ISBN 978-81-7596-733-5	2011
8	Soft Skills: Enhancing Employability, Rao, M.S. Connecting Campus with Corporate ISBN: 978-93-80578-38-5	2011

9. Objective : To familiarize the students to work in industry and working culture of the industrial system. He should also be able to write and present the work done during the course.
1. Subject Code: **CE 405** Course Title: **Design of Steel Structures**
2. Contact Hours : L: 3 T: 0 P: 2
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits : 4
6. Semester : VII
7. Subject Area : DCC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

S. N.	Contents	Contact Hours
1	Fasteners, Connections for transmitting axial forces, eccentric load and beam reactions including moments, Analysis and design of semi-rigid connections.	10
2	Tension members, compression members including built-up, column splice and column bases.	08
3	Design of beams (laterally restrained & unrestrained) including built up, un-symmetrically bending, grillage beams and Beam-column.	10
4	Buckled and un-buckled design of plate girder and gantry girders.	8
5	Roof trusses and steel Tanks. Appropriate experiments would be taken up.	6
Total		42

S. No.	Contents	Contact Hours
1	<p>Irrigation and Drainage works: Necessity and types of irrigation, soil moisture and crop water relations, consumptive use of water, water logging, design concepts of surface and sub surface drainage system.</p> <p>Rivers and River training works: Rivers of different types, river behavior, meanders, cut offs, river training works and their design.</p> <p>Canal irrigation : Types of reservoirs, reservoir yield, reservoirs losses, multi-purpose river valley projects. Types of canal, parts of canal irrigation system, assessment of water requirements, estimation of channel losses, design of lined and unlined channels, regime and semi-theoretical approaches (Kennedy's theory and Lacey's theory). Modular and non-modular outlets.</p>	8
2	<p>Regulation works and Cross-Drainage structures: Classification of falls and their suitability, design of notch falls, Sharda falls and Montague falls, distributary head regulators and escapes. Necessity of cross-drainage structures, their types and selection, comparative merits and demerits, design of aqueduct and siphon aqueduct.</p>	7
3	<p>Diversion Head works: Selection of site and layout, different parts of diversion head works, types of weirs and barrages, design of weirs on permeable foundation barrage by Bligh's and Khosla's methods. Silt excluders and silt ejectors.</p> <p>Dams and Spillways: Introduction, suitable sites, types of dams, forces acting on a gravity dam, stability requirements, arch dams, buttress dams, earth and rock-fill dams, design of gravity dams. Introduction, types of spillways, design of spillways, energy dissipation below spillways.</p>	8
4	<p>Hydrology: Hydrologic cycle, rain gauge, measurement of rainfall, rain fall analysis, infiltration, runoff estimation; Stream flows and their measurement, Stage-discharge curves, Unit & Synthetic hydrographs and their applications, flood hydrograph. Peak flows estimation and flood frequency analysis. Reservoir routing and channel routing.</p>	13
6	<p>Ground water engineering: Aquifers, movement of ground water, steady and unsteady flow towards wells in confined and unconfined aquifers, well losses.</p>	5
Total		41

5	Specifications and Quality Control: General and detail specification for important engineering works, quality control.	5
Total		40

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Punmia B. C., and Khandelwal K. K., "PERT and CPM", Laxmi Publications, New Delhi. (ISBN 0-07-23998904-1)	1999
2	R. L. Peurify, "Construction Planning: Equipment and Methods", Tata McGraw Hill, Inc. (ISBN 0-07-0476158-7)	2000
3	Satyanarayanan & Saxena, "Construction Planning and Equipment", Standard Publishers Distributors, New Delhi. (ISBN 0-01-257859-8)	1998

DEPARTMENTAL ELECTIVE COURSES

10. Details of Course :

S. No.	Contents	Contact Hours
1	Clay mineralogy, clay-water electrolyte system, soil structure and fabric.	06
2	Effective stress, pore pressure, hydraulic conductivity and its directional variations, electro-osmosis	08
3	Seepage behaviour of soil- flownet constructions by various technique, seepage in layered soils, filter design, seepage through dam body	08
4	Consolidation: one-dimensional and generalised consolidation theories, primary and secondary consolidation, determination of C_v by various methods, visco elastic models, sand drains, effect of smear, numerical solutions, consolidation settlements.	08
5	Shear behaviour of soils, pore pressure parameters, UU, CU&CD tests, stress path method for settlement analysis. Total & effective stress-path, water content contours, stress history, Anisotropy of strength, Thixotropy, Creep, Determination of in situ undrained shear strength, stress-strain characteristics of soils, Determination of modulus values	10
Total		40

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Soil Mechanics: Principle and Practice: GE Barnes (ISBN 9-03-088753-7)	2000
2.	Advanced Soil Mechanics: BM Das (ISBN 0-77-04915-8)	1997
3.	Soil Mechanics: TW Lambe and RV Whitman (ISBN 0-71-6059714-1)	1987
4.	Fundamentals of Soil Behaviour: James K. Mitchell (ISBN 7-83-4697512-6)	1993
5.	Principles of Soil Mechanics: RF Scott (ISBN 9-54-3564799-8)	1963

5	Detailed Design and arrangement of Sewage Treatment Plant: Preliminary/ Primary treatment - Screens , Grit chamber, Skimming tank, Primary sedimentation etc; Physico- chemical & Chemical treatment systems; Biological treatment systems- Activated Sludge process, Fixed Film (Trickle Filter), Oxidation Ditch, Oxidation Pond UASB ; Disposal/ treatment of sludge-Anaerobic digestion, sludge drying beds. Design of Septic/ Imhoff Tank. Design of low cost in situ/ onsite Sanitation systems Emerging Technologies for Waste Water Treatment and their design	13
Total		41

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Garg, S.K, "Water Supply Engineering, Vol 1", Khanna Publishers, New Delhi.(ISBN 0-07-6080479-3)	2007
2	Garg, S.K, "Sewage Disposal and Air Pollution Engineering, Vol 2", Khanna Publishers, New Delhi(ISBN 0-74-7458244-7)	2007
3	Qasim, SR;Motley, EM and Zhu, G. "Water Works Engineering.: Planning, design and operation, Prentice Hall NJ, USA(ISBN 0-72-579462-7)	2000
4	Metcalf & Eddy. " Waste Water Engineering: Treatment and reuse, TMH,New Delhi. (ISBN 3-87-824967-8)	2003
5	CPHEEO Manual on Water Supply & treatment, Min of Urban GOI	1999
6	CPHEEO Manual on Sewerage and Sewage treatment ,Min of Urban GOI	2013
7	Arceewala SJ, Waste water treatment for Pollution control, TMH, New Delhi	2000

8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

S. N.	Contents	Contact Hours
1	Introduction of structural dynamics, types of prescribed loads, Coordinates and coordinate transformation, Principles of Dynamics: D'Alembert's principle, Principle of Virtual Work, Hamilton's principle, mathematical and analytical models., Free body diagram and equation of motion Single degree freedom systems, Simple problems on un-damped and damped free vibration, frequency, period and amplitude, Logarithmic decrement, , Types of damping system,	10
2	Response of SDOF System to Harmonic excitation, Dynamic excitation, Vibration of un-damped two degrees of freedom system, Simple problems, Free vibration of MDOF System, Natural Frequencies & Mode shapes Rayleigh's method, Stodola method	10
3	Modal response of MDOF systems, Mathematical model of MDOF Systems, Seismic coefficient and response spectrum method of analysis as per IS 1893 Code Provision. Simple problems on response of MDOF systems to earth quake excitation.	10
4	Strong ground motion measurements, Seismic hazard analysis, Measurement of dynamic soil properties, One dimensional ground response analysis, Liquefaction: Susceptibility and effects, Simple problems.	10
5	Concept of Earthquake Resistant Design, IS 1893: Part I 2002; Provisions for Seismic Design: Ductile reinforcement detailing as per IS 13920 Code., Provisions of IS 4326: 1993, IS 13827 1993, IS 13828 1993 Appropriate experiments would be taken up.	8
Total		48

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1.	Dynamics of Structures A K Chopra Published by Prentice Hall. ISBN 10: 013156174X ISBN 13: 9780131561748	2003
2.	Dynamics of structures , Ray W. Clough and Joseph Penzien , McGraw-Hill , New York, 1993. ISBN 0-07-011394-7.	1993
3.	Elements of Earthquake Engineering Jai Krishna, Brijesh Chandra South Asian Publishers ISBN-10: 8170031834 ISBN-13: 978-8170031833	2000
4.	Structural Dynamics: Theory and Computation Mario Paz CBS Publishers & Distributors Pvt. Ltd New Delhi (2004) ISBN 10: 8123909780 ISBN 13 : 9788123909783	2004
5.	Geotechnical Earthquake Engineering, Steven L. Kramer, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. Delhi ISBN 81-317-0718-0	2007
6.	Theory of Vibration with Application, William T. Thomson, Marie Dillon Dahleh, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. Delhi ISBN 81-317-0932-9	2007
7.	IS 1893 Part I : 2002 BIS New Delhi	2002
8.	IS 13920,: 1993 BIS New Delhi	1993
9.	IS 4326: 1993 New Delhi	1993
10.	IS 13827, IS13828: 1993 BIS New Delhi	1993

1. Subject Code: **CE 315** Course Title: **ROCK ENGINEERING**
2. Contact Hours : L: 3 T: 0 P: 2
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits : 4
6. Semester : V

7. Subject Area : DEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

Sl. No.	Contents	Contact Hours
1	Introduction , Classification and index properties of rock, Stress in rock mechanics and rock engineering, stress component and stress matrix, principal stress, in situ stress, method of stress determination, Strain, strain tensor.	8
2	Rock strength and failure criteria , laboratory testing of rocks, Griffith's theory, Coulomb's theory, in-situ tests on rock mass; deformation characteristics, mechanical, thermal and electrical properties of rock mass.	8
3	Rock exploration , site investigation, preliminary, detail and geophysical investigation, exploratory drilling methods and their utility, Exploration planning, Foundation on rocks; bearing capacity of intact and jointed rocks; general consideration for design of foundation, treatment of rock defects.	8
4	Openings in rock mass and stresses around openings; pressure tunnels, development of plastic zone; rock support needed to avoid plastic deformation; lined and unlined tunnels; support pressure and slip of the joint; underground excavation and subsidence.	8
5	Rock slopes ; types of rock slope failure, rock slope analysis-conventional and numerical method, rock slope stabilization, rock bolt and anchors, methods of construction; problems associated with tunnels, tunnelling in various subsoil conditions and rocks. Appropriate experiments would be taken up.	8
Total		40

10. Details of Course :

S. No.	Contents	Contact Hours
1	Generation rates and Characteristics / composition of Municipal waste, Bio-Medical Waste, Plastic Waste ,e-waste and hazardous wastes. Solid waste in Industries and Agricultural sector.Municipal Solid Waste Management and Handling Rules 2015 , Ministry of Environment, Forests and Climate Change applicable to Collection, segregation, Storage and Transportation of Municipal Solid waste. Solid waste handling methods, Treatment and Disposal of wastes	11
2	Solid waste handling methods : Segregation - material Recycle ,reuse ;Sanitary Land fill concept and Design of Engineered Sanitary Land fill, Lechate problem; Biomethanation ; Composting- type of composting, theory, design of conventional compost/ Vermi compost plant; Thermal methods- Incineration, Pyrolysis & its by-products etc . Cost Economics studies: Transportation route & cost optimization	10
3	Air Pollution : regulations in India,Chemistry, meterology, plume rise and dispersion, Effects on human health and environment. Measurement and analysis of pollutants such as CO, HC, SPM, SO _x , NO _x , and ozone etc	11
4	Basic principles and Design of Air Pollution Control: Cyclones ,Bag filters, particulate chambers, Electrostatic precipitator, Scrubbers, catalytic converters	08
Total		41

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Rao, Environmental Pollution and Control Engineering, New Age International pub(ISBN 0-07-05245745-6)	latest
2	Garg, S.K, "Sewage Disposal and Air Pollution Engineering, Vol 2", Khanna Publishers, New Delhi(ISBN 4-97-8145632-7)	2007
3	Rao , Air Pollution, TMH(ISBN 0-70-744826-8)	2000

2	<p>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, optical radiation models, summary of visible to shortwave region models, spectral reflectance curves, radiation calculation. thermal sensors and their characteristics. Thermal infrared region models, radiation components – surface-emitted component, surface-reflectance, atmospheric emitted component, path-emitted component, total at-sensor, emitted radiance, interpretation of thermal images – day and night images, emissivity consideration, thermal inertia considerations. factors affecting analysis of thermal images, data models for thermal image analysis.</p>	6
3	<p>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. Stereoscopy, measurement and parallax and height determination, photogrammetric mapping. Digital data bank, digital image, digital image processing introduction to, preprocessing, enhancement, classification, visual image interpretation, Introduction to software - MATLAB, ENVI, ERDAS, AutoCAD etc</p>	6
4	<p>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.</p>	8
5	<p>Applications of Geoinformatics, Remote Sensing, GIS and GPS: Land cover classification survey and Mapping, Digital elevation model (DEM), GPS surveys, Introduction to SAR data processing and SAR interferometry, Applications in Disaster management, geology, forest security and military projects. Appropriate experiments would be taken up.</p>	6
Total		32

10. Details of Course

:

S. N.	Contents	Contact Hours
1	Unit 01: Understanding disaster Concept of disaster, Different approaches, Concept of Risk, Levels of disasters, Disaster phenomena and events (<i>Global, national and regional</i>)	8
2	Unit 02: Hazards and Vulnerability Natural and man-made hazards; response time, frequency and forewarning levels of different hazards, Characteristics and damage potential of natural hazards; hazard assessment, Dimensions of vulnerability factors; vulnerability assessment, Vulnerability and disaster risk, Vulnerabilities to flood and earthquake hazards	8
3	Unit 03: Disaster management mechanism Concepts of risk management and crisis management, Disaster management cycle, Response and Recovery, Development, Prevention, Mitigation and Preparedness, Planning for relief	8
4	Unit 04: Capacity building Capacity building: Concept, Structural and nonstructural measures, Capacity assessment; strengthening capacity for reducing risk, Counter-disaster resources and their utility in disaster management, Legislative support at the state and national levels, BIS guidelines	8
5	Unit 05: Planning for disaster management Coping strategies; alternative adjustment processes, Changing concepts of disaster management, Industrial safety plan; safety norms and survival kits, Mass media and disaster management, Strategies for disaster management planning, Steps for formulating a disaster risk reduction plan, Disaster management Act and Policy in India, Organisational structure for disaster management in India, Preparation of state and district disaster management plans Appropriate experiments would be taken up.	8
Total		40

10. Details of Course :

S. No.	Contents	Contact Hours
1.	Introduction: importance and history of ground improvement. Mechanical Modifications: properties of compacted soil, compaction control tests, field compaction, applications. Precompression: technique, procedure, and applications. Sand Drains: method, procedure and applications.	8
2.	Prefabricated vertical drains: method of installation and design. Soil Stabilisation: shallow stabilisation with additives like lime, fly ash, cement and other materials. Chemical modifications and Grouting. Hydraulic modification: dewatering systems, filtration, drainage and seepage control with geosynthetics.	8
3.	Vibroflotation technique, stone columns, sand compaction piles, dynamic compaction technique, ground freezing, and electro-osmosis.	8
4.	Ground modification by soil reinforcement: reinforcement techniques, use of flexible geosynthetic reinforcement in bearing capacity improvement, slope stability, erosion control, retaining walls and pavements.	8
5.	Difficult soils: collapsible soils, physical parameters and identification, collapse settlement, improvement techniques; expansive soils, general nature, swell test and swelling pressure tests, classification, improvement of expansive soils.	8
TOTAL		40

11.Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Das, B. M. (2011). <i>Principles of Foundation Engineering</i> . Cengage Learning. (ISBN 0-07-525486-7)	2007
2	Koerner, R. M. (2012). <i>Designing with Geosynthetics, Vol. 1 & 2</i> . Xlibris Corporation. (ISBN 0-254-755246-7)	2007
3	Moseley, M. P., Kirsch, K. (2004). <i>Ground Improvement</i> . Spon Press. (ISBN 0-07-678125-74)	2000

7. Subject Area : DEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

S. No.	Contents	Contact hours
1	Tunneling: tunnel alignment and grade, size and shape of tunnel, methods of tunneling in soft soil, compressed air and shield tunneling, shafts in tunnels ,safety measures, ventilation, lighting and drainage in tunnels.	10
2	Introduction and planning of harbor: historical development of water transportation in india and policy, classification of harbours, major port in india and administrative set up, harbor economics. Harbor classification, characteristics of good harbor, and principles of harbor planning, site selection criteria and lay out of harboures.	10
3	Natural phenomena: wind, waves tides and currents phenomena, their generation characteristics and effects on marine structures, silting, erosion and littoral drift.	6
4	Design aspect and consideration for dock and harbor: marine structures; general design aspects, breakwaters – function, types, general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories- function, types, suitability, design and construction features, docks and locks; tidal basin, wet docks, design consideration, operation of lock gates and passage, repair docks, graving docks, floating docks, marine railway. Port amenities; ferry, transfer bridge, floating landing stages, transit sheds, ware houses, cold storage, aprons, cargo handling equipments, purpose and general description.	8
5	Harbor maintenance: navigation aids; channel and entrance demarcation, buoys, beacons, light house electronic communication device. Harbor maintenance; costal protection – purpose and devices, dredging, purpose, methods. Dredgers- types, suitability, disposal of dredged material. Appropriate experiments would be taken up.	6
Total		40

3	Basic steps of stiffness method, stiffness matrix in local axis system of beam and plane frame members, transformation of stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions.	10
4	Stiffness matrix in local axis system of grid and plane truss members, transformation of the stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions.	10
5	Stiffness matrix in local axis system of space truss and space frame members, transformation of stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions. Appropriate experiments would be taken up.	10
Total		40

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1.	Matrix Methods of Structural Analysis, P.N. Godbole, R.S. Sonparote and S.U. Dhote, PHI Learning Pvt. Ltd., Delhi (ISBN-978-81-203-4984-1)	2014
2.	Matrix Analysis of Framed Structures, William Weaver Jr. and James M. Gere, CBS Publishers and Distributors, New Delhi (ISBN: 81-239-1151-3)	2004
3.	Elementary Structural Analysis, Charles Head Norris, John Benson Wilbur and Senol Utku, Tata McGraw-Hill Publishing Company Limited, New Delhi (ISBN:0-07-058116-9)	2005

10. Details of Course

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S. No.	Contents	Contact Hours
1	Introduction to Computational Fluid Dynamics (CFD) : Introduction to Computational Fluid Dynamics, Applications of Computational Fluid, Advantages of Computational Fluid Dynamics. Governing Equations : Principles of Conservation: Continuity Equation, Navier Stokes Equation, Energy Equation . General Structure of Conservation Equations.	6
2	Classification of Partial Differential Equations and Physical Behaviour : Mathematical classification of Partial Differential Equation ; Illustrative examples of elliptic, parabolic and hyperbolic equations, Physical examples of elliptic, parabolic and hyperbolic partial differential equations.	6
3	Discretization Basics of discretization. Boundary conditions : Possible types of boundary conditions, Conservativeness, Boundedness, Transportiveness, boundary layer treatment; variable property; interface and free surface treatment. Well posed problem. Classification and Overview of Numerical Methods: Classification into various types of equation; parabolic elliptic and hyperbolic; boundary and initial conditions; over view of numerical methods.	6
4	Discretization Methods : Finite Difference Methods Finite Difference Technique: Finite difference methods; different means for formulating finite difference equation; Taylor series expansion. Implicit, fully explicit and Crank-Nicholson scheme. Finite Volume Methods Finite Volume Technique: Finite volume methods; different types of finite volume grids; approximation of surface and volume integrals; interpolation methods; central, upwind and hybrid formulations and comparison for convection-diffusion problem. Finite Element Methods Finite Element Methods: Finite element methods; Rayleigh-Ritz, Galerkin and Least square methods; interpolation functions; one and two dimensional elements; applications.	8
5	Solution Methods Methods of Solution: Solution of finite difference equations; iterative methods; matrix inversion methods; ADI method; operator splitting; fast Fourier transform. Time integration Methods: Single and multilevel methods; predictor corrector methods; stability analysis; Applications to transient conduction and advection-diffusion problems.	6

4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits : 4
6. Semester : VII
7. Subject Area : DEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

S. N.	Contents	Contact Hours
1	Design of staircase supported at ends, staircase supported at side of going, design of flat slab, analysis and design of slab by yield line method.	08
2	Design of continues beams, cantilever beams, design of isolated rectangular footing, design of rectangular and trapezoidal Combined columns footing.	08
3	Design of cantilever retaining wall and design of counterfort retaining wall.	08
4	Design of circular and rectangular water tanks on ground and under-ground, forroement water tanks, introduction to Intz tank and I.S. specifications for water tanks.	08
5	Introduction to folded plates & shells and introduction to portal frames. Appropriate experiments would be taken up.	08
Total		40

2	Curved failure surfaces: Their utility and analytical/graphical predictions from Mohr-Coulomb envelope and circle of stresses. Earth pressure computations by friction circle method. Earth pressure distribution on walls with limited/restrained deformations, Dubravo's analysis. Earth pressures on sheet piles, braced excavations. Design of supporting system of excavations. Arching in soils. Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits. Design charts for practical use.	18
3	Modern concept of analysis of piles and pile groups: Axially, laterally loaded piles and groups. Interaction analysis. Reese and Matlock's Tunneling solution. Elastic continuum and elasto-plastic analysis of piles and pile groups. Hrennikoff's analysis. Ultimate lateral resistance of piles by various approaches. Non-linear load-deflection response. Uplift capacity of piles and anchors.	16
Total		46

11. Suggested books:

S.No.	Name of Books/ Authors	Year of Publication
1	Selvadurai, A.P.S., Elastic analysis of Soil Foundation Interaction, Elsevier, (ISBN 0-07-054859-7)	1979
2	Poulos, H.G., & Davis, E.H., Pile Foundation Analysis & Design, John Wiley, (ISBN 0-07-35965469-1)	1980
3	Scott, R.F., Foundation Analysis, Prentice Hall (ISBN 0-07-066554-8)	1981
4	Structure Soil Interaction-State of Art Report, Institution of Structure Engineers (ISBN 0-07-0956674-9)	1978
5	Kramer, S.L., Geotechnical Earthquake Engineering (ISBN 0-07-07899867-8)	2006
6	ACI 336, Suggested Analysis and Design Procedure for Combined Footings & Mats, American Concrete Institute, Delhi, (ISBN 0-07-0585665-1)	1988
7	Bowles, Foundation analysis and design, McGraw Hill (ISBN 0-07-0/8564-1)	1998

10. Details of Course

:

S. N.	Contents	Contact Hours
1	Road accident situation in India, international comparison of road accident. Multidisciplinary approach to planning for traffic safety and injury control, causes of road accidents, control measures, roles of vehicle, roadway traffic, driver, and environment, crash and injury causations; accident analysis, pre crash and post crash models, conflict points.	10
2	Safety auditing: road safety audit, stages of auditing, methods involved; case studies. Mixed traffic flow, traffic calming measures, strategies adopted in various countries, case studies.	10
3	Transportation related pollution: road transport related air pollution, sources of air pollution, effects of weather conditions, vehicular emission parameters, urban and non urban traffic noise sources, noise pollution, noise barriers, pollution standards measurement and analysis of vehicular emission, imitative measures.	10
4	EIA: EIA requirements of highways projects, procedure, MoEF, UK guidelines; EIA practices in India.	10
Total		40

11. Suggested books:

S.N.	Name of Books/ Authors	Year of Publication
1	Traffic Engineering and Transport planning, Dr. L.R.Kadiyali, Khanna Publishers, ISBN No. :81-7409-220-X	2007
2	Highway engineering, , Dr. L.R.Kadiyali, Khanna Publishers, ISBN No: 81-7409-165-3	2006
3	Principles of Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, Cengage Learning, ISBN-13:979-81-315-1246-3	2010
4	Transportation Engineering and Planning, C.S.Papacostas, PHI, ISBN-81-203-2154-5	2002
5	Highway engineering, Dr. S. K. Sharma ,S CHAND, ISBN 81-219-0131-6	2012

10. Details of Course :

Sl. No.	Contents	Contact Hrs.
1	Introduction, fundamentals of vibrations, dynamical systems, vibration of elementary systems-mass, spring, dashpot systems, degree of freedom, dynamic properties of geo-materials, propagation of wave in granular media;	8
2	laboratory and field tests for evaluation of dynamic soil properties; analysis and design of foundations for hammers, reciprocating engines and turbo generators; dynamic stiffness of single pile and pile groups;.	10
3	vibration isolation and damping; theories for vibration of foundations on elastic media; design procedures for foundations with dynamic load and construction features;	10
4	application of elastic homogeneous half space solution, lumped parameter solution;	6
5	large deformation problem, liquefaction of soils & cyclic mobility	6
Total		

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Soil Dynamics by Shamsheer Prakash (ISBN 0-07-759614-1)	1981
2	An Introduction to Soil Dynamics by Arnold Verruijt (ISBN 0-07-057845-1)	2006
3	Geotechnical Earthquake Engineering by S.L. Kramer (ISBN 0-07-049504-1)	1996
4	Soil Dynamics and Machine Foundation by Swami Saran (ISBN 0-07-749805-1)	1999
5	Principles of Soil Dynamics by BM Das and GV Ramana (ISBN 0-07-744825-1)	2010

4	Introduction, sediment properties, threshold conditions for uniform sediments, exposure and sheltering effects in non-uniform sediments, critical tractive stress of non-uniform cohesion-less sediments and cohesive soil, regimes of flow, analysis of ripples, dunes and anti-dunes, resistance to flow and velocity distribution in alluvial streams, Bed load, suspended load and wash load computation of bed load for uniform and non uniform sediments; Mechanism of suspension, distribution of suspended load, computation of suspended load and total load.	7
5	Design of flood control structures: Basic causes of flood, flood prone areas in India and their problems, case history of some important river basins of India. Engineering and administrative methods of flood plane regulation. Economic aspects of flood control schemes, cost benefit analysis. Flood forecasting, flood warning and flood fighting.	9
Total		41

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Garg, S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi. (ISBN 0-07-799852-1)	2014
2	Asawa, G. L. "Irrigation and Water Resources Engineering", New Age International Publishers. (ISBN 0-07-715846-1)	1993
3	Srivastava, Rajesh "Flow through Open Channels", Oxford University Press, New Delhi. (ISBN 0-07-982555-1)	2008
4	Verma, C.V.J. and Rao, M.K. "River Behaviour Management and Training" Central Board of Irrigation and Power, New Delhi. (ISBN 0-07-985452-1)	1989

1. Subject Code: **CE 423** Course Title: **Advanced transportation engineering**
2. Contact Hours : L: 3 T: 0 P: 2
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits : 4
6. Semester : VII
7. Subject Area : DEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

S. No.	Contents	Contact Hours
1	Transportation system planning: transportation policy, and types of surveys. OD matrix.travel demand forecasting, trip generation, model split analysis, trip distribution, route assignment analysis, transport network, network	6
2	Urban transport technology: classification mass and rapid transit system, introduction to intelligent transportation system(ITS), public transport policy, Intermediate transport, Introduction to BRT, Mono rail, sky bus, metro projects, grade separated interchanges such as flyovers, under passes, overpasses, concept of integrated inter model transit system	6

3	Transport economics and financing: vehicle operations cost, running cost, pollution cost, value of travel time, road damage cost, congestion cost, accident cost economic evaluation, various economic studies, transportation plans- benefit cost method, net present value method, first year rate of return method, internal rate of return method and comparison of various methods. Pavement management systems. Highway financing, pay as you go method, credit financing, private financing, BOT, BOOT, dedicated road funds, road pricing, tolls, private provisions, advantages and limitations.	8
4	Traffic systems: traffic impacts, traffic studies, level of service, traffic analysis process, basic traffic theory, intersection studies, turning movements, flow, delays, and queuing, signal design, grade separated intersection, parking studies, traffic generation and parking, parking facilities.	8
5	Study of flexible pavement: IRC,AASHTO guide to design of pavement, pavement failure, strengthening of pavement- benkelmen beam method. Distress in pavements.	6
6	Study of rigid pavement: concept of rigid pavement, comparisons of rigid over flexible pavement, design as per IRC guidelines, design of joints, dowel bars, temperature reinforcement, pavement failure, overlay types and their design as per IRC.	6
Total		40

11. Suggested books:

S.N.	Name of Books/ Authors	Year of Publication
1	Traffic Engineering and Transport planning, Dr. L.R.Kadiyali, Khanna Publishers,ISBN No. :81-7409-220-X	2014
2	Highway engineering, , Dr. L.R.Kadiyali, Khanna Publishers, ISBN No: 81-7409-165-3	1993
3	Principles of Traffic and Highway Engineeering,Nicholas J. Garber and Lester A. Hoel,Cengage Learning,ISBN-13:979-81-315-1246-3	2008
4	Transportation Engineering and Planning, C.S.Papacostas, PHI, ISBN-81-203-2154-5	1989

10. Details of Course

:

Sl. No.	Contents	Contact Hours
1.	Basic Concepts and Fundamentals Definition and properties of Fluids, Fluid as continuum, Lagrangian and Eulerian description, Velocity and stress field, Fluid statics, Fluid Kinematics.	5
2.	Governing Equations of Fluid Motion Reynolds transport theorem, Integral and differential forms of governing equations: mass, momentum and energy conservation equations, Navier-Stokes equations, Euler's equation, Bernoulli's Equation.	5
3.	Exact solutions of Navier-Stokes Equations Couette flows, Poiseuille flows, Fully developed flows in non-circular cross-sections, Unsteady flows, Creeping flows.	5
4.	Potential Flows Revisit of fluid kinematics, Stream and Velocity potential function, Circulation, Irrotational vortex, Basic plane potential flows: Uniform stream; Source and Sink; Vortex flow, Doublet, Superposition of basic plane potential flows, Flow past a circular cylinder, Magnus effect; Kutta-Joukowski lift theorem; Concept of lift and drag.	8
5.	Laminar Boundary Layers Boundary layer equations, Boundary layer thickness, Boundary layer on a flat plate, similarity solutions, Integral form of boundary layer equations, Approximate Methods, Flow separation, Entry flow into a duct.	5
6.	Elements of Stability Theory Concept of small-disturbance stability, Orr-Sommerfeld equation, Inviscid stability theory, Boundary layer stability, Thermal instability, Transition to turbulence.	6
7.	Turbulent Flow Introduction, Fluctuations and time-averaging, General equations of turbulent flow, Turbulent boundary layer equation, Flat plate turbulent boundary layer, Turbulent pipe flow, Prandtl mixing hypothesis, Turbulence modeling, Free turbulent flows.	6
Total		40

2	Design of at grade intersections: capacity and LOS, design of rotary and signalized intersections, vehicle actuated signals, signal co-ordination, area traffic control system (ATCS), Pedestrian planning at grade intersections.	6
3	Design of grade separated inter sections :design of grade separators, principles, design criteria, layout design, GAD preparation, pedestrian food over bridge and subway design, pedestrian planning and grade separated intersections.	8
4	Parking facilities: parking, demand, characteristics, space inventory, accumulation, duration, turn over, design of multi storied and surface parking facility.	8
5	Design of terminal facilities: bus terminus, design principles, design elements, design and case studies of inter modal transfer facilities, case studies of bus and rail terminals	6
Total		34

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Punmia B. C., and Khandelwal K. K., "PERT and CPM", Laxmi Publications, New Delhi. (ISBN 0-07-504049-8)	2015
2	R. L. Peurify, "Construction Planning: Equipment and Methods", Tata McGraw Hill, Inc. (ISBN 0-07-796845-3)	2002
3	Satyanarayanan & Saxena, "Construction Planning and Equipment", Standard Publishers Distributors, New Delhi. (ISBN 0-07-741859-01)	2008
4	Punmia B. C., and Khandelwal K. K., "PERT and CPM", Laxmi Publications, New Delhi. (ISBN 0-07-954504-1)	2014
5	R. L. Peurify, "Construction Planning: Equipment and Methods", Tata McGraw Hill, Inc. (ISBN 0-07-976432-1)	1990
6	Satyanarayanan & Saxena, "Construction Planning and Equipment", Standard Publishers Distributors, New Delhi. (ISBN 0-07-4646474-1)	1993

6. Semester : VIII
7. Subject Area : DEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

Sl. No.	Contents	Contact Hours
1	Geoenvironmental Engineering: Waste generation; Sources of subsurface contamination, Effect of contamination on geotechnical properties, Waste disposal on land, Types of landfills, design and operation of landfills, subsurface contamination control and remediation, types of barrier materials, Design of ash ponds.	18
2	Geo-Hazards Engineering: Engineering seismology, Strong ground motion, Seismic hazard analysis, Local site effects and design ground motions, liquefaction hazard evaluations and remedial measures Landslides: Causes and Phenomenon associated with landslides, effect of rainfall on slope stability, earthquake triggered landslides, landslide prevention, control and remedial measures Other Hazards: ground subsidence, ground heave, erosion.	24
Total		42

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Rowe R.K., "Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, (ISBN 0-07-874924-1)	2000
2	Reddi L.N. and Inyang, H. I., "Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, (ISBN 0-07-787889-5)	2000

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	Introduction : Origin and age of groundwater, Distribution of water on the earth, Groundwater resources in India, vertical distribution of groundwater, the hydrological cycle, utilization of groundwater..	6
2	Groundwater Flow Equations: Basics equations, Darcy's law, Hydraulic conductivity, ground flow rates, Ground flow directions, General flow equations and Unsaturated flow. Zone of aeration and saturation. Aquifers Aquiclude, Aquitard, Aquifuge, Groundwater flow in confined and unconfined aquifers, Theims'Equations for wells.	10
3	Groundwater Modeling : Prous media models, Analog modelia models, Electrical analog models and Digital computer models.	8
4	Artificial Recharge of Groundwater : Cocept of artificial recharge, Recharge methods, Artificial recharge on Long Island and Induced Recharge.	8
5	Remote Sensing: Introduction, Application of Remote sensing, Basics principles of Remote sensing, Energy balance equation for radiation, Data collected by Remote sensing, Analysis of Remote sensing data	8
Total		40

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1.	MacMillan, & M. E. Harr, " Groundwater and Seepage" - McGraw Hill (ISBN 0-078-92846-1)	1987
2.	Aggarwal V.C., "Ground water Hydrology" PHI Learning Pvt. Ltd (ISBN 0-07-986143-4)	2011
3.	David Keith Todd, " Ground water Hydrology" OHAN WOLEY & SONS (ISBN 0-27-648222-0)	1987

1. Subject Code: **CE 420** Course Title: : **Traffic Engineering**
2. Contact Hours : L: 3 T: 0 P: 2
3. Examination Duration (Hrs.) : Theory: 3 Practical: 0
4. Relative Weight : CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits : 4
6. Semester : VIII
7. Subject Area : DEC
8. Pre-requisite : NIL
9. Objective : To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course :

Sl. No.	Contents	Contact Hours
1	Traffic engineering studies and analysis: Objectives of traffic engineering study, Components of road traffic and their effect on road traffic, Spot speeds, speed and delay study, traffic volume survey, O-D survey, Parking study.	10
2	Theory of Traffic Flow: Basic diagram of traffic flow, Vehicular stream equations and diagrams, shock waves in traffic, freeway capacity and level of service, probabilistic aspects of traffic flow.	10
3	Traffic Control: Traffic control through time sharing and space sharing concepts, traffic signs, traffic signals, road markings, islands, types of traffic signal systems, signal coordination, application of ITS.	10
4	Traffic Safety: Accident data collection, analysis of accident data, causes and prevention of accidents, pedestrian safety, road lights and Road safety audit.	10
Total		40

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1.	Kadiyali L.R "Traffic Engineering and Transport Planning" Khanna Publications(ISBN 0-07-573667-1)	1987
2.	Pignatyro L., "Traffic Engineering-Theory and Practice", John Wiley(ISBN 0-07-760054-1)	2011
3.	McShane W.R. and Roess R.P., "Traffic Engineering" Prentice Hall(ISBN 0-75-986523-1)	1987

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 ofThread.	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

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, Diffe-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

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

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

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

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. 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

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 Kingsely Jr, 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

- Subject Code: **EE-357** Course Title: **Utilization of Electrical Energy**
- Contact Hours : L: 3 T: 0 P: 0
- Examination Duration (Hrs.) : Theory: 3 Practical: 0
- Relative Weight : CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
- Credits : 3
- Semester : V
- Subject Area : OEC
- Pre-requisite : NIL
- 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.

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

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

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

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. 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.

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

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

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. Cleetus CE Research Centre, Morgantown
3	Concurrent Engineering Fundamentals: Integrated Product Development Prasad Prentice hall India

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)

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

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

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	<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 of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages.</p> <p>Simulation of Mechanical Systems: Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems.</p>	10
Total		42

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.

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

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	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

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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