Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2014

8 Semester

Civil Engineering

Update on Nov. 2017

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Civil Engineering

Sno	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total		MSE-I	MSE-II	TA	ESE	
SEVENTH SEMESTER												
1	CV1401	Water Resource Engineering	3	1	0	4	4	15	15	10	60	3
2	CV1402	Structural Analysis-II	3	1	0	4	4	15	15	10	60	3
3	CV1403	**Lab:** Structural Analysis-II	0	0	2	2	1			40	60	--
4	CV1422	Transportation Engineering –II	4	0	0	4	4	15	15	10	60	3
5	CV1441	Environmental Engineering -II	4	0	0	4	4	15	15	10	60	3
6	CV1442	**Lab :** Computer Applications in Civil Engineering	0	0	2	2	1			40	60	--
7	**Professional Elective II**		3	0	0	3	3	15	15	10	60	3
	CV1410	PE II: Traffic Engineering										
	CV1411	PE II: Advanced Hydraulics										
	CV1413	PE II: Natural Resources Management										
	CV1443	PE II: Optimization Techniques										
	CV1444	PE II: Structural Dynamics										
	CV1445	PE II: Soil Dynamics										
	CV1406	Industrial Training/ CRT	0	0	0	0	2			100		
8	CV1407	Project- Phase I	0	0	4	4	4			40	60	--
Total			**17**	**2**	**8**	**27**	**27**					
EIGHTH SEMESTER												
1	CV1421	Estimating & Costing	3	1	0	4	4	15	15	10	60	4
2	**Professional Elective III**		3	0	0	3	3	15	15	10	60	3
	CV1446	PE III: New Engineering Materials										
	CV1447	PE III: Advanced RCC										
	CV1448	PE III: Remote Sensing and GIS										
	CV1449	PE III: Earth and Earth Retaining Structures										
	CV1450	PE III: Watershed Management										
	CV1451	PE III: Urban Transportation Planning										
3	**Professional Elective IV**		3	0	0	3	3	15	15	10	60	3
	CV1427	PE IV: Wastewater Treatment										
	CV1428	PE IV: Earthquake Engineering										
	CV1429	PE IV: Matrix Analysis of Structures										
	CV1452	PE IV: Advanced Surveying										
	CV1453	PE IV: Foundation Engineering										
	CV1454	PE IV: Water Power Engineering										
4	**Professional Elective V**		3	0	0	3	3	15	15	10	60	3
	CV1432	PE V: Water Transmission and Distribution Systems										
	CV1433	PE V: Advanced Steel Design										
	CV1434	PE V: Maintenance and Rehabilitation Engineering										
	CV1455	PE V: Finite Element Method										
	CV1456	PE V: Advanced Geotechnical Engineering										
	CV1457	PE V: Design of Bridge Structures										
	CV1458	PE V: Advanced Foundation Engineering										
5	CV1424	Comprehensive Viva-voce	0	0	0	0	3				100	
6	CV1425	Project- Phase II	0	0	8	8	8			40	60	
7	CV1426	Extra / Co-curricular / Competitive Examination	0	0	0	0	2			100		
Total			**12**	**1**	**8**	**21**	**26**					

Chairperson		**Version**	**1.01**
Dean (Acad. Matters)		**Date of Release**	**Nov. 2017**

Applicable for AY 2017-18 Onwards

VIII SEMESTER

CV1421	Estimating and Costing			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the importance of subject and definition involved in the estimation of various structures. 2. To understand the estimates of buildings (Load bearing and framed structure) culverts, Hydraulic structures water supply and sanitary works etc. 3. Earthwork estimates in road, hill roads and canals. 4. Detail estimates of steel in RCC works with bar bending schedule. 5. To understand the procedure of submitting the tenders and types of contracts. 6. To understand the writing and developing detailed specification of items and finding out quantities of various materials in different items. 7. To understand the concept of valuation, methods of valuation and rent fixation. 8. To understand the methods of accounting	1. An ability to understand the definitions in estimates of structures. 2. An ability to develop the specifications and find out the quantities of materials in different items to prepare the estimate 3. An ability to workout the valuation and rent of civil engineering structures 4. An ability to do accounting 5. An ability to workout the estimate and costing of building, road, hydraulic structures etc. [Field problems] 6. An ability to fill the tenders and carry out the construction of civil engineering structures
Mapped Program Outcomes: a, b, c, d, e, f, j, l, n	

UNIT – 1 :

General: Importance of the subject, purpose of quantity estimates, mode and unit of measurement as per I.S.1200, methods and stages of estimates, items of a work and their description, approximate estimation of Civil engineering works.

Proposal and Development of Project: Project Management Consultant & their role, various important terminologies required like work charged establishment, muster roll, contingencies, percentage charges, measurement book, overheads etc**.**

[09 Hrs.]

UNIT – 2 :

Specifications: Purpose and principles of specifications, types of specifications, writing and developing detailed specifications of important items.

Cost Build up: Purpose and principles, importance of Schedule of rates (CSR) in cost estimates, factors affecting analysis of rates, information from National Building Organization, task work, factors affecting task work, market rates, escalation.

[08 Hrs.]

UNIT – 3 :

Valuation: Purpose of valuation, factors affecting value of property price and cost, market value, potential value, sentimental value, scrap value etc. real estate, guide edged securities, net and gross return, tenure of land, valuation of land, free hold and leasehold, sinking fund, depreciation, capitalized value, methods of valuation, differed annuity, time cost relationship, valuation table and rent fixation.

[09 Hrs.]

UNIT – 4 :

Cost Accounting: Various methods, classification of cost, direct and indirect charges, distribution of overheads, M.A.S. Account, issue rates and store account. Earthwork estimates in road, hill roads and canals. Mass excavation and mass haul curves

[08 Hrs.]

UNIT – 5 :

Quantity and cost estimates: Methods of detailed estimates, forms used for detailed estimates, working out the quantities of various materials required for construction of different Civil Engineering works like building, road works etc., detailed estimates of steel in RCC works, bar bending schedule.

[09 Hrs.]

VIII SEMESTER

CV1421	Estimating and Costing			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

UNIT – 6 :

Arranging Works : Construction agencies, method of carrying out works, arranging contract works, pretender and contract planning, tender notice, acceptance of tender, essentials of contract, types of contracts, conditions of contract, contract documents, various schedules in the tender document, measurement and payment to contractor, arbitration

[09 Hrs.]

Text books:

1. Estimating, Costing, Specification & valuation in Civil Engineering, Chakraborti M. UBS Publication, Calcutta, 2010

Reference books:

1. Estimating & Costing, Chandola S.P. &Vazirani V.N, Khanna Publishers 2-B, Nath market, Naisarak, Delhi, 2010
2. Estimating & Costing in civil Engineering, Dutta B.N, UBS Publishers distributors ltd., 5 Ansari road, New Delhi, February 1999
3. Estimating, Costing and valuation, Rangwala S.C, Charotar Publishing house, opposite Amul diary, court road, Anand, 2011

VIII SEMESTER

CV1446	PE III - New Engineering Materials			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand various civil engineering materials. 2. Understand various methods of testing of materials. 3. Understanding and use of various codes related to the civil engineering materials.	1. An ability to understand different high quality materials for Civil Engineering applications 2. An ability to use engineering materials for better and durable Civil Engineering Structures 3. An ability to utilize bionondegradbale materials for Civil Engineers 4. An ability to understand the use of Composite sections for effective utilization of materials
Mapped Program Outcomes: h, j, k	

UNIT – 1 :
Steel fiber reinforced concrete, Properties, Aspect ratio, strength and durability.
Fiber reinforced plastics, other types of fibers and their applications.

[07 Hrs.]

UNIT – 2 :
Light weight concrete, Ferro cement concrete, their types, foam concrete, workability, durability and composition, application.

[07 Hrs.]

UNIT – 3 :
Fly ash blended concrete, replacement procedures, effect of admixtures, adhesives, bond strength, durability, applications.

[06 Hrs.]

UNIT – 4 :
High-grade concrete, high strength performance concrete, tremieconcrete.

[06 Hrs.]

UNIT – 5 :
New engineering materials like light weight steel profile, aluminium profiles, pressed steel sections.

[06 Hrs.]

UNIT – 6 :
Introduction to steel concrete composite including infill, encased sections, properties of shear connectors, use of IS:11384, IRC 220.

[07 Hrs.]

Text Books:
1. Properties of Concrete, Neville A. M., Pearson Education Limited
2. Special Concretes, Rafatsiddhequi, Galgotia Publications
3. Concrete Technology, M Gambhir, Tata Mcgraw Hill Education Private Limited.

Reference Books:
1. Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
2. Shetty M. S, Concrete Technology, S. Chand Publisher.

VIII SEMESTER

CV1448	PE III: Remote Sensing & GIS			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understanding the Geoinformatics approach 2. Teach fundamental principles involved in RS and GIS 3. Understand the Fundamentals of Remote sensing Products 4. Know the Indian Remote Sensing Program 5. Role of Remote Sensing for various surveys and information extraction 6. Know about different software available in RS and GIS 7. Learn fundamental procedures in RS and GIS 8. Teach data integration and defining problems in digital format	The students should be able to 1. Identify, describe and explain the fundamental of principles of aerial photography and remote sensing. 2. Apply the basics of raster and vector data formats and able to interpret it. 3. Asses and compare spatial and non-spatial data, projection system, topology, geo referencing while using remote sensing data. 4. Collect logical information and apply digital image processing for supervised/un-supervised classification of given data
Mapped Program Outcomes: d, e, j,	

UNIT – I :
Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures

[06 Hrs.]

UNIT – II :
Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geostationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote-sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

[07 Hrs.]

UNIT – III :
Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data

[07 Hrs.]

UNIT – IV :
Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging.

[07 Hrs.]

UNIT – V :
Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

[06 Hrs.]

UNIT – VI :
Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

[06 Hrs.]

Text Books:
1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Sabins, Floyd F
4. Higher surveying volume III: Dr B C Punmia

Reference Books:-
1. Concepts and Techniques of GIS 2005 C.P. Lo Albert PHI Learning
2. Remote Sensing Of the Environment – An Earth Resource Perspective 2004 John R. Jensen Pearson Education.

VIII SEMESTER

CV1449	PE III-Earth & Earth Retaining Structures			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Students are expected to analyze and design rigid, flexible earth retaining structures, 2. To learn sheet piles and bulk heads. 3. To get knowledge of embankments, cofferdams and braced cuts.	1. Students will be able to analyze and design rigid, flexible earth retaining structures. 2. Students will be able to carry out stress analysis of sheet piles and bulk heads. 3. Students will understand the basics of compacted embankments, cofferdams and braced cuts.
Mapped Program Outcomes: a, b, c, d	

UNIT – 1 :
Earth Pressure on retaining wall
Rankine's and Coulomb's theories of earth pressure Poncelet's and Culmann's graphical constructions for active and passive pressures, Effects of wall movement, wall friction, type of slip surface, wall back angle, backfill slope angle, surcharge and line loads on earth pressure, Direction and point of application of earth thrust.

[07 Hrs.]

UNIT – 2 :
Stability of Earth retaining structures
Types of walls: gravity, cantilever walls, walls with counterforts and relief shelves, their typical dimensional details. Stability requirement of overturning, sliding, bearing capacity failure: overall stability against shear failure in backfill & foundation soil; application of geo-synthetics in earth retaining structure.

[06 Hrs.]

UNIT – 3 :
Sheet pileretaining structures
Sheet pile wall and bulk heads. Types of sheet piles, constructional features of cantilever and anchored sheet pile walls, their suitability, Analysis for design of cantilever walls in cohesionless and cohesive soils, Analysis for anchored sheet pile walls with free & fixed end support conditions, Blum's criteria, Deadman and anchored, design principles.

[06 Hrs.]

UNIT – 4 :
Embankments
Control of field compaction, placement moisture content during field compaction, effect of compactive effort on compaction of clayey and sandy soils, effect of lifts in deep compaction, correction for excluded grain size in laboratory compaction. Theories of compaction: water film and lubrication concept, microstructure concept.

[07 Hrs.]

UNIT – 5 :
Stability of slopes :
Friction circle method, factor of safety, Taylor's stability numbers & stability charts, base failure, stability of earthen slopes for steady seepage and sudden drawdown, approximate analysis for plain slip surface, Bishop's method of slope stability.

[07 Hrs.]

UNIT – 6 :
Cofferdams and Caissons:
Types, stability analysis of cellular and Diapharm type cofferdams and caissons, TVA method of interlocked stresses.
Braced cuts:
Sheeting and bracing system in shallow and deep vertical cuts in different types of soils. Failure modes; lateral pressure distribution on sheeting, stability of bottom of excavation.

[06 Hrs.]

VIII SEMESTER

CV1449	**PE III-Earth & Earth Retaining Structures**			**L= 3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.
4. Basic applied Mechanics, Gopal Ranjan, New Age International.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VIII SEMESTER

CV1450	PE III-Watershed Management			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
rious objectives of the course will be: 1. To understand the watershed and its characteristics. 2. To understand the importance of watershed management. 3. To plan and design of Watershed protection, conservation elements. 4. To envisage the management plan of Watershed.	The students will be able to: 1. Understand the Watershed and its characteristics. 2. Understand the importance of watershed in terms of drinking water, irrigation water, increases in ground water. 3. Plan and design of Watershed protection, conservation elements. 4. Envisage the management plan of Watershed.
Mapped Program Outcomes: a, e, h, k & l	

UNIT – 1 :
Soil and Water– Issues related to plant life like composition of soil, water requirement of crops, necessary conditions for plant growth etc. Soils, their origin and classification.Land classification for WM, Land capability rating, determination of land capability class, land capability and suitability surveys, (Desalination of water logging and its remedial measures).

[07 Hrs.]

UNIT – 2 :
Watershed Behavior– Physical elements of a watershed, effects of land use changes on hydrological cycle component Concept of vegetative management of water yield and quality. Watershed Experiments, extrapolation of results from representative and experimental basins, Regional studies. (Water auditing and Bench marking).Soil erosion – problem, types, conservation, and control measures in agricultural and non-agricultural land.

[06 Hrs.]

UNIT – 3 :
Water conservation and Harvesting– Agronomical measures in soil and water conservation. examples and critical reviews. Inventory techniques for precipitation runoff, soil, timber, range-land and wild life Water harvesting techniques – Elements, Development of modern harvesting Techniques Estimation of peak runoff rate Land capability classification.

[06 Hrs.]

UNIT – 4 :
Erosion process – Factors affecting erosion, Types of erosion, Assessment of erosion, Control measures for erosion Conservative practices-Objective and general practices, land and soil classification, identification of critical areas, (Catchment area treatment).

[07 Hrs.]

UNIT – 5 :
Watershed Management- Objectives of Planning, Watershed Projects, Guidelines for Project Preparation. Approach in Government programmes, people's participation, conservation farming, watershed-management planning and identification of problems, objectives and priorities, socioeconomic survey, use of tools like GIS.

[07 Hrs.]

UNIT – 6 :
Watershed Modelling: Runoff components –Simple parametric models – Curve Number Method, variable source area models; quasi- physically based models; a simple physically based model. Rainfall-Runoff modelling, USLE model for soil erosion.

[06 Hrs.]

Text Books:
1. J. V. S Murthy, Watershed Management, New Age International Publishers, 1998.
2. Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 2003.
3. V.V. N. Murthy, Land and Water Management, Kalyani Publishers, 1994.

Reference Books:
1. Ghanshyam Das, Hydrology &soil Conservation Engineering, PHI Publication.

VIII SEMESTER

CV1451	PE III: Urban Transportation Planning			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**4 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
idents Understood about: 1. Importance of Planning, analysis and implementation. 2. Traffic forecasting and Environmental impacts. 3. O &D Studies based on trip distribution and generation. 4. Various Modes and Model split analysis 5. Traffic Regulation, ITS in urban traffic and illumination system.	1. Students understood about traffic forecasting and its effects on environment. 2. Students understood the necessity and importance of Traffic regulations. 3. Students understood the necessity and arrangement of street lighting. 4. Students understood about planning process and traffic problems.
Mapped Program Outcomes: a, b, c, e, h, i, k	

UNIT – 1 :
Importance of urban transport planning
Transport Planning Process: Scope, Independence of the land use and traffic, system approach to transport planning, stages, survey and analysis, forecast analysis and future condition of plan synthesis, evolution, programme adoption and implementation, continuing study, citizen participation, difficulties in transport planning process.
[07 Hrs.]

UNIT – 2 :
Traffic forecasting: Necessity, Limitations, Types of traffic, Methods of forecasting, Period of forecasting.
Traffic and environment: Introduction, Detrimental effects on environment, Noise, Air pollution, vibration, Visual intrusion and degrading aesthetics, Severance and land consumption, evaluation procedure, environmental areas, situation in India.
[06 Hrs.]

UNIT – 3 :
Trip Generation: introduc6tion and definition, trip purpose, factors governing trip generation and attraction rates.
Trip Distribution: Introduction, Methods: Uniform factor method, Average factor method. Farther method, Furness Method, Criticism of Growth factor method, Tranner's Model, Gravity Model, Opportunity Model. Delay studies.
[06 Hrs.]

UNIT – 4 :
Model Split: General consideration, factors affecting, Model split in transport planning process, recent development. Mode choice analysis. Introduction to Various modes of urban transportation: Local trains, Metro, Monorails, BRTS and MRTS.
[07 Hrs.]

UNIT – 5 :
Regulation of traffic: Basic principles of regulation, scope of traffic regulation, traffic laws, regulation of speed, vehicles, driver & traffic, parking & enforcement regulations, motor vehicle act.
[06 Hrs.]

UNIT – 6 :
Nature of traffic problems in cities: Growth of town & traffic, present difficulties in urban traffic condition, measures, Application of ITS in urban traffic management, VMS, Signal coordination, parking management.
Urban Street Light systems: Need, laws of illumination, decrement by artificial lightening, appearance of lighted pavement, types of surface, distribution of light, mounting height, spacing, lantern arrangement, types of lamps, quantity of illumination, lamp installation of T-junction and cross roads, illumination of traffic rotaries, lighting at bends, dual carriageway, roads, bridges, tunnels, maintenance of lightening installation.
[07 Hrs.]

Text books:
1. Traffic Engineering and Transport Planning, Kadiyali, L.R, Khanna Publishers
2. Principles & Practice of Highway Engineering, Chakroborty P Das, Khanna Publisher, 2000
3. Highway Engineering, Rangawala B.S, Charotar Publishing House, 2011
Reference books:
1. IRC Handbook and MOST Specifications, Indian Road Congress
2. Fundamentals of Transportation and traffic Operations. Pergamon, Elsevier science Inc
3. Institute of Transportation Engineers, 'Manual of Transportation Engineering Studies', Prentice Hall

VIII SEMESTER

CV1427	PE IV: Waste Water Treatment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To study necessity and objectives of wastewater treatment and layout of a wastewater treatment plant. 2. To study disposal methods for wastewater. 3. To study principles of working and design of various waste water treatment units and processes. 4. To understand need & processes of Advanced wastewater treatment. 5. To study treatment of wastewater from various industries.	1. An ability to understand the necessity of water quality management 2. An ability to design various treatment units for waste water 3. An ability to understand advanced treatment processes for waste water 4. An ability to understand treatment of waste water from various industires.
Mapped Program Outcomes: a, c, e	

UNIT – 1 :
Holistic approach to Wastewater management, Effluent & Stream standards, wastewater characteristics and their significance, disposal methods for wastewater on land and in water and its impact, self-purification of streams

[06 Hrs.]

UNIT – 2 :
Preliminary and primary treatment processes and units: Screens, grit chamber and primary settling tank- Principles, types & designs.

[07 Hrs.]

UNIT – 3 :
Secondary treatment processes & units: Concepts in biological treatment, bacterial growth and biological oxidation, Activated sludge process, Trickling filter- Principles, types. Simple design problems.

[07 Hrs.]

UNIT – 4 :
Other biological treatment units: Aerated lagoons, Stabilization Ponds, Up flow Sludge Blanket Reactors, fixed film reactors, Sludge De watering methods, Sludge Digester.

[06 Hrs.]

UNIT – 5 :
Need of advanced treatment, removal of trace organics, micro screening and control of nutrients, nitrification and de-nitrification, removal of phosphorus.

[07 Hrs.]

UNIT – 6 :
Treatment alternatives for Industrial waste, volume reduction, strength reduction, equalization tank, neutralization tank, Specific industrial wastewater treatment for paper and pulp industry, sugar industry, distillery industry, dairy industry, textile industry.

[06 Hrs.]

Text Books:
1. B.C. Punmia, 2010, Wastewater engineering, Laxmi Publications (P) Ltd., New Delhi.
2. P. N. Modi, 2008, Sewage Treatment & Disposal and Waste Water Engineering, Standard Book House.
3. S. K. Garg, 2010, Environmental Engineering (Volume-2), Khanna Publication.
4. M. N. Rao, 2007, Waste water treatment, oxford and IBH publishing.
5. Patwardhan, 2008, Industrial wastewater Treatment, PHI learning Pvt. Ltd.
6. G.L. Karia and R. A. Christian, 2006, Wastewater Treatment, PHI learning Pvt. Ltd.

Reference Books:
1. Metcalf and Eddy, 2006, Wastewater Treatment Disposal and reuse, Tata McGraw Hill publishing company Ltd.

VIII SEMESTER

CV1428	PE IV : Earthquake Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study geology of earth and interior. 2. To expose student to understand the detailed study of earthquake. 3. To expose students to understand various provisions related to earthquake design. 4. To understand various aspects of tall structures. 5. To understand detailing of RCC members for ductile behavior as IS code provisions. 6. To understand various effects of earthquakes on structures	After completion of course the student will be able 1. An ability to understand the necessity and Importance of Earthquake Engineering 2. An ability to understand the provision of IS Code used for Earthquake Resistance Design of Structure 3. An ability to design the structure by considering various loads. 4. An ability to understand various special aspects in Multi-story buildings, ductile detailing and its design. 5. An ability to prepare mathematical model to design tall structures. 6. An ability to study of Damages caused due to past Earthquake in & outside India and remedial measures
Mapped Program Outcomes: a, c, e, l, m	

UNIT – 1 :
Origin of earthquakes, engineering geology, seismicity of the world, faults, earthquake waves, quantification of earthquake (magnitude, energy, intensity of earthquake), measurements of earthquake, analysis of earthquake records and its interpretation.

[07 Hrs.]

UNIT – 2 :
Determination of magnitude, epicenter, epicenter distances, focal depth, seismic zoning, ground motion and their characteristics, factors affecting ground motions, causes or sources of earthquake damages, evaluation of seismic hazards, concept of response spectra, generation of response spectrum from available earthquake.

[06 Hrs.]

UNIT – 3 :
Study of IS: 1893, IS: 13920 for analysis and ductile detailing of RCC structures and other related codes, concept of earthquake resistant design, design philosophy, virtues of earthquake resistant design.

[06 Hrs.]

UNIT – 4 :
Design and detailing of RCC members, beam, column, shear wall and beam-column joints for ductile behaviors, calculation of base shear distribution to various floors.

[07 Hrs.]

UNIT – 5 :
Special aspects in multi-storey buildings, effect of torsion, flexible first storey, P-delta effect, and soil-structure interaction on building response, drift limitation, soil liquefaction during earthquakes.

[07 Hrs.]

UNIT – 6 :
Load bearing structures, masonry structures, strengthening and rehabilitation of non-engineered building for earthquake, earthquake disaster management, mitigation and social aspects, lessons from past earthquakes.

[06 Hrs.]

Text Books :
1. Agrawal & Shrikhande, Design of Earthquake Resistant Structures, 3rd 2006, Prentice – Hall of India Pvt. Ltd.
2. Roberto Villaverde, Fundamental Concepts of Earthquake Engineering, 2009, CRC Press
3. Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley

VIII SEMESTER

CV1428	**PE IV : Earthquake Engineering**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

References Books:

1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org / iaee / E_FrontCover.pdf, NICEE Guidelines for Earthquake Resistant Non-Engineered Construction, 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India.
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition
4. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, 2001, Kluwer Academic Publisher
5. Paulay, T. & Prestiley M.J.N., Seismic design of R C & Masonry Buildings, 2nd 1999, John Willey & Sons

VIII SEMESTER

CV1429	PE IV: Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
At the end of the course the student will be able to understand 1. Basic concepts of direct stiffness method. 2. Analysis of various structural elements by stiffness method	1. An ability to understand the stiffness method for analyzing statically indeterminate structures. 2. An ability to model the behaviour of various structural elements and systems. 3. An ability to understand the effect of various loading and support conditions on structural elements and systems. 4. An ability to implement the computer program to analyse the structures.
Mapped Program Outcomes: a, e,g,h,j,k l, m	

UNIT – 1 :
Basic terminology, degree of freedom, basic concept of direct stiffness method, derivation of all stiffness coefficients, formulation of compatibility equations, rotation transformation matrix.

[06 Hrs.]

UNIT – 2 :
Analysis of Beam (without axial deformation): Formulation of elemental stiffness matrix for Beam, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, uniformly distributed load and moment, assembly of global load matrix, solution to problem without sinking of support with maximum three degree of freedom.

[07 Hrs.]

UNIT – 3 :
Analysis of Plane Truss: Formulation of elemental stiffness matrix and global stiffness matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, assembly of global load matrix, solution to problem of plane truss with maximum three degree of freedom.

[06 Hrs.]

UNIT – 4 :
Analysis of Plane Frame (Without axial deformation): Formulation of elemental stiffness matrix and, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[06 Hrs.]

UNIT – 5 :
Analysis of Plane frame (With axial deformation): Formulation of elemental stiffness matrix and transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[07 Hrs.]

UNIT – 6 :
Analysis of Beam with sinking of support, analysis of member for temperature loading, lack of fit in trusses with maximum three degree of freedom, storing of global stiffness matrix, full storage, banded storage and band minimization.

[07 Hrs.]

VIII SEMESTER

CV1429	PE IV: Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Gere and Weaver, Matrix Method of Structural Analysis, McGraw Hill. 2004
2. Kanchi M.B., Matrix Method of structural Analysis, New age International,1993
3. Martin H.C. Introduction to Matrix Method of Structural Analysis, 1966
4. Pandit Gupta, Structural Analysis: A Matrix Approach,Tata McGraw-Hill, 2001

Reference Books:

1. Meghre A.S. &Deshmukh S.K., Matrix Method of Structural Analysis,Charotar Publishing House Pvt. Limited, 2003
2. Flemming Computer Analysis of Structures, McGraw-Hill Education , 1996
3. Wang C K,, Intermediate Structural Analysis, McGraw-Hill Education, 2010
4. S. Rajasekaran, G. Sankarasubramanian Computational Structural Mechanics, PHI Learning Private Limited, 2004

VIII SEMESTER

CV1452	PE IV: Advanced Surveying			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the importance of Higher surveying in the field of civil engineering 2. To understand fundamental knowledge of working principles of Advanced Electronic Devices and Total Station. 3. To understand fundamental knowledge of principles of GPS, GIS and Remote Sensing.	1. The students will be able to understand the advantages of electronic surveying over conventional surveying methods. 2. The student will be able to handle and to understand the working principle of Advanced Electronic Devices and total Station. 3. The student will be able to understand and to apply knowledge of GPS, GIS and Remote Sensing technique /data for required purpose.
Mapped Program Outcomes: a, b, d, e, f, g, k, l,	

UNIT – 1 :
ELECTRONIC SURVEYING
Basic principles, classifications, applications, comparison with conventional surveying, electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments, application of Lasers in distance measurement.

[07 Hrs.]

UNIT – 2 :
TOTAL STATION SURVEYING
Basic Principle - Classifications -Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system.Care and maintenance of Total Station instruments. Modern positioning systems - Traversing and Trilateration.

[06 Hrs.]

UNIT – 3 :
GPS SURVEYING
Introduction: Introduction to GPS, History, Satellite Navigations constellations today – GPS system, GLONASS system, Galileo System, GPS Errors Future of GPS. Reference Systems and Coordinate systems: Geodetic coordinate systems, Datum transformations, Height systems, Time systems. Modernization plans of navigational satellites, Hardware and software improvements.

[07 Hrs.]

UNIT – 4 :
GIS SURVEYING
Map – mapping concepts, analysis with paper based maps, limitations, GIS- Definition, advantages of digital maps. Fundamentals of GIS – Information Systems, Modeling Real World Features Data , Data Formats – Spatial and Non-spatial, Components, Data Collection and Input, Hardware – Computing, printing and scanning systems; Introduction to Software – Standard Packages like Arcview, ArcGIS, Autocad Map, Map Info etc.

[06 Hrs.]

UNIT – 5 :
PHYSICS OF REMOTE SENSING
Physics of Remote Sensing: Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation - Reflectance, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, Atmospheric windows, Spectral reflectance of Earth's surface features, Multi concept of Remote Sensing.

[06 Hrs.]

UNIT – 6 :
MICROWAVE REMOTE SENSING
Microwave Remote Sensing: Active and Passive Systems, Advantages, Platforms and Sensors, Microwave Radiation and Simulation, Principles of Radar – Resolution, Range, Angular Measurements, Microwave Scattering, Imagery – characteristics and Interpretation.
Applications: Geosciences, Water Resources, Land use – Land cover, Transportation

[07 Hrs.]

VIII SEMESTER

CV1452	**PE IV: Advanced Surveying**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

Text Books:

4. James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 2011.
5. Charles Elach & Jakob van Zyl., Introduction to the physics and techniques of Remote Sensing, John Wiley & Sons publications, 2006.
6. Thanappan Subash., Geographical Information System, Lambert Academic Publishing, 2011
7. Lillesand T.M and Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2008.
8. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993

References Books:

1. Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Berlin, 2003.
2. Satheesh Gopi, rasathishkumar, N. madhu, “Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007

VIII SEMESTER

CV1453	PE IV-Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study basic features and theory of shallow foundations. 2. To familiarize the students with different types of shallow foundations. Analysis and geotechnical design of shallow foundations. 3. Student will develop ability to predict and estimate settlement of foundations. 4. To study basic features and theory of deep foundations. 5. To acquaint students with foundations provided in various soil conditions for offshore structures.	1. Students will be able to understand basic features and theory of shallow foundations. 2. Students will be able to estimate settlement of foundations. 3. Students will understand basic features and theory of deep foundations. 4. Students will understand basics of offshore foundations.
Mapped Program Outcomes: a, b, c, d	

UNIT – 1 :
Ultimate bearing capacity of shallow foundation:
Features & criteria for various types of shear failure in foundation soil, types of footings and rafts, location and depth of footings. Overview of theories of bearing capacity under centric vertical, inclined & vertical loads; Terzaghi's theory, theories of Meyerhof's, Balla, Vesic, Reddy-Srinivasan etc. Effect of interference of footings, Ultimate load computation for rectangular footing/raft; for limited depth of soil below the foundation. Theoretical approaches for footings on slope. Ultimate & allowable bearing capacity determination and settlement estimation from the data of penetration tests (SPT & SCPT), plate load test and pressure meter test.

[07 Hrs.]

UNIT – 2 :
Settlement analysis
Boussineq's theory, pressure distribution for strip load, square and circular areas, pressure bulbs, contact pressure distribution. Methods of computation f elastic settlement, Janbu's equation, use of strain influence factor, Schmentmann's approach, settlement from elasticity theory, computation of primary and secondary consolidation of foundation on Normally Consolidated Clay& Over Consolidated Clay; Differential settlement & its permissible values. Control of excessive settlement. Special considerations for rafts on sand and clay, concept and design principle of floating raft foundation, proportioning the footings of public building for equal settlement. Overview of shallow foundation on reinforced earth under centric vertical load**.**

[06 Hrs.]

UNIT – 3 :
Axially loaded Piles
Load transfer mechanism, piles in sand and clay, computation of end bearing and skin resistance; α, βand λ methods, drained and undrained capacity, effect of pile installation methods on load capacity and pile behaviors, critical length of piles in sands, dynamic formulae: limitations. Effects of pile driving on ground, & adjacent structures. Constructional features of bored piles in different soil conditions, large diameter bored piles and pier foundations, Load Capacity of single and multi-undereamed piles, various methods to determine base resistance of piles (Meyerhof, Vesic, Janbu, Coyle-Castello etc.).

[06 Hrs.]

UNIT – 4 :
Laterally loaded piles:
Applications, lateral resistance of single pile, long and short piles, failure mechanisms, Approaches of analysis with Winkler model for soil, Reese-Matlock's analysis, Equivalent cantilever approach, IS code provisions, p-y concept, construction of p-y curves for piles in soft clays and sands, effect of cyclic loading, salient features & design charts of Brom's analysis for different pile-soil systems.

[07 Hrs.]

UNIT – 5 :
Foundation for offshore structures:
Nature and magnitude of loads, features and construction methods of template type piled platforms, Gravity platforms and Tension leg platforms, Pile behaviours under environmental loading conditions.

[06 Hrs.]

VIII SEMESTER

CV1453	PE IV-Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

UNIT – 6 :

Anchor foundations:

Behaviour and failure mechanism of shallow anchors & deep anchors, Ultimate anchor capacity;

Well foundations:

Introduction to methods based on elastic theory and ultimate resistance, function and design of component parts of well foundations.

[07 Hrs.]

Assignment work shall comprise:
3 to 4 assignment based on the above syllabus.

Text Books:

1. Principles of Foundation Engineering, 1999, B.M. Das, PWS publishing co.
2. Advanced Foundation Engineering**,** 2007, Murthy V.N.S, CBS Publishing.
3. Foundation Engineering Handbook, 2004, H.Y. Fang.

Reference Books:

Theory & practice of foundation Design, 2002, Som N.N. & Das S.C., Sarita Prakashan, Meerut.

VIII SEMESTER

CV1454	PE IV: Water Power Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
rious objectives of the course will be: 1. To understand the significance of water power engineering 2. To correlate between hydrology and water power engineering 3. To understand the concepts of turbines and pumped storage tanks. 4. To design units of hydroelectric power station & its components.	1. An ability to understand Analysis and design of different components of hydro power plant 2. An ability to understand Analysis and design of surge tanks
d Program Outcomes: a, e, h, k & l	

UNIT – 1 :

Introduction: Sources of energy, types of power station, choice of type of generation, components of water power project, types and general layouts of various hydropower schemes, General arrangements of a power station, power house, sub-structure and super structure, underground power station–necessity, principal, types, development and economics.

[06 Hrs.]

UNIT – 2 :

Estimation of hydro power potential, basic water power equation, gross head, net head, nature of supply, storage and pondage, Method of computing hydrographs, mass curves, flow duration curves.

Nature of demand: Load curve, load duration curves, load factor, plant factor, plant use factor, firm power secondary power.

[07 Hrs.]

UNIT – 3 :

Intake structures: Types, level of intake, hydraulics of intake structures, trash rack, transition, intake gates. Conduits: Types, economic section, power canals, pen-stock types hydraulic design and economic diameter pipe supports, anchor blocks, tunnels – classification, location and hydraulic design, tunnel linings.

[06 Hrs.]

UNIT – 4 :

Surge Tank: Functions and behaviour of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, fore-bay.

[07 Hrs.]

UNIT – 5 :

Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitations Tail race: Functions, types, channel and tunnel draft tubes, function and principal types

[07 Hrs.]

UNIT-6:

Pumped storage plants, purpose and general layout of pumped storage schemes, main types, typical arrangements of the upper reservoirs, economics of pumped storage plants. Introduction to Tidal power stations.

[06 Hrs.]

Text Books:

1. Dandekar M. M. & Sharma K. N, Water Power Engineering, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Sharma R.K. & Sharma T.K., Water Power Engineering, S. Chand Publication.
3. Streeter V. L. & Wylie E. B, Hydraulic Transient, McGraw Hill Book Company, New York.

Reference Books:

1. Chaudhary Hanif, Applied Hydraulic Transients, Van Nostrand Rein Hold Company, New York. Varshney, Water power engineering, Nemchand Publication.

VIII SEMESTER

CV1432	PE V: Water Transmission & Distribution Systems			L= 3	T= 0	P= 0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
The students will learn the:- 1. Reservoir, pump, various valves in distribution system. 2. Analysis of flow in looped networks using various methods. 3. Analysis of flow in serial networks using node flow analysis. 4. Optimal and Economical diameter of pumping main 5. Design of water distribution networks 6. Optimization of water distribution network.	1. An ability to understand the Reservoir, pump, various valves in distribution system 2. An ability to understand Analysis of flow in looped networks using various methods 3. An ability to understand Analysis of flow in serial networks using node flow analysis 4. An ability to understand Optimal and Economical diameter of pumping main 5. An ability to understand Design of water distribution networks 6. An ability to understand Optimization of water distribution network
d Program Outcomes:a, c, e & k	

UNIT-1:
General Hydraulic Principles, Head loss formulae- Darcy-Weisbach formula, Hazen – Williams formula, Modified Hazen - Williams formula, minor losses, continuity equation,, Equivalent length of Pipes, Three Reservoirs, Pumps and Valves in Water distribution systems.

[06 Hrs.]

UNIT-2:
Types of network, Formulation of Equations for looped Water Distribution Networks, Analysis of flow in looped networks using Hardy-Cross method and Newton-Raphson method.

[07 Hrs.]

UNIT-3
Node flow analysis of water distribution networks (NFA): Necessity of node flow analysis, classification of node according to HGL, classification of node according to flow, compatibility, node head-discharge relationship, Application of NFA technique to serial networks.

[07Hrs.]

UNIT-4:
Optimal and Economical diameter of pumping main. Design of pumping main considering rising main diameter as continuous as well as discrete variable.

[06Hrs.]

UNIT-5:
Design of water distribution networks: Design of single source branching network using Critical path method, Determining number of branching configuration for a looped network by graph theory, Use of path concept and minimum spanning tree concept.

[07 Hrs.]

UNIT-6
Formulation of optimization model, Application of critical path method for design of looped networks. Application of Cost-head loss ratio method for optimal design of branched networks.

[06 Hrs.]

Text Books:
1. Bhave P.R., Optimal design of water distribution networks, 2003-12-04, Alpha science International Ltd
2. Bhave P.R., & Gupta R., Analysis of Water Distribution Networks, 2006-09-18, Alpha science International Ltd

Reference Books:
1. Jeppson, R.W., Analysis of flow in pipe networks, June 1976, Butterworth-Heinemann,
2. Walski, T. M., Analysis of water distribution systems, November 1992, Krieger Publishing Company CPHEEO, Ministry of Urban Development, New Delhi, 2005
3. Manual on Water Supply and Treatment, CPHEEO, GOI

VIII SEMESTER

CV1433	PE V: Advanced Steel Design			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the fundamental design philosophies of steel structures 2. To study the codal provision for design of steel structure 2. To study the relationship between structural analysis and design provisions.	1. An ability to understand different types of loading with respect to structural parameters. 2. An ability to identify the type of structure and its design methodology. 3. An ability to utilize the application of Indian Standard code for design purpose.
Mapped Program Outcomes: **a, c, e, i, k, l, m**	

UNIT – 1 :
Eccentric Connection: Bracket Connection, Seat Connection, Frame Connection, Moment Resistant Connection. Drawing in sketchbook about eccentric connections.

[10 Hrs.]

UNIT – 2 :
Plate Girder: Element of Plate Girder, Types of Section, Design Aspect, Stability of Webs, Design of Welded Plate Girder. Drawing in sketchbook about plate girder.

[10 Hrs.]

UNIT – 3 :
Gantry Girder: Loads Acting onGantry Girder, Fatigue Effect, Selection of Gantry Girder, Design of Gantry Girder. Drawing in sketchbook about Gantry girder

[09 Hrs.]

UNIT – 4 :
Bridges: Types of Bridges, Foot Bridge, Road Bridge, Railway Bridge, Rolled Beam Bridges, Plate Girder Bridges, Truss Bridge, Through And Deck Type Bridges, Weight of Bridge Truss By Empirical Formulae, Loading on Footways, IRC Loading, Loading on Railway Bridges, Design Of Footbridge.
Introduction to Bearings-Types of Bearings, Bearing Pads, Rocker, Roller and elastomeric Bearings.
Drawing in sketchbook about bearings and bridges.

[10 Hrs.]

Text Books:
1. Design of steel structures, By S. Arya and J. L. Ajmani, New Chand & Bros. Roorkee, 1992
2. Fundamentals of Structural Steel Design, By M. L. Gambhir, Mc Graw Hill Education, 2013
3. Design of Steel Structures, By N. Subramanian, OXFORD University Press, First Edition, 2008

Reference Books:
1. Limit State Design of Steel Structures, By S. K. Duggal, Mc Graw Hill Education Private Limited, 2011
2. Design of Steel Structures, By P. Dayaratnam, S. Chand Publication, 2008

VIII SEMESTER

CV1434	PE V: Maintenance & Rehabilitation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand various civil engineering materials. 2. Understand various methods of testing of materials. 3. Understanding and use of various codes related to the civil engineering materials.	1. Students will know about different high quality materials for civil engineering applications. 2. Ability to use materials for better and durable Civil Engineering Structures. 3. Student will know about various smart materials.
Mapped Program Outcomes: h, j, k	

UNIT – 1:

Introduction:

Deterioration of structures, definition of maintenance, need for maintenance of different civil engineering structures, maintenance characteristics, negligence and poor maintenance of structures, quantification of maintenance.

Classification of Maintenance Work:

Servicing, rectification, replacement, planned, unplanned, preventive, corrective, predictable and avoidable maintenance works, renovation and rehabilitation, routine maintenance of buildings, specifications for maintenance works.

Common Maintenance Problems:

Related to various civil engineering structures and systems, techniques of maintenance, areas prone to frequent maintenance, causes that aggravate maintenance work like high-rise buildings, special construction methods, new materials, accessibility, Environment etc., construction details for prevention.

[07 Hrs.]

UNIT – 2 :

Factors Affecting Frequency and Magnitude of Maintenance Work:

Over loading, movement of grounds, temperature variations, moisture, leakages and dampness, chemical actions and corrosion, growth of trees, earthquake, flood and fire, riots and vandalism, design defects, defects in construction and use of materials, choice of materials for durability and maintainability, design, exposure and other factors affecting durability, precautions to increase durability, effect of pollution on buildings.

Inspection, Identification and diagnosis of common defects and failures with possible causes in buildings, Roads, bridges, railway tracks, canals and C.D. Works, tunnels and special structures like service reservoirs, water supply, sewerage, storm water drains.

[06 Hrs.]

UNIT – 3 :

Preventive Maintenance: General, site selection, choice of structural systems and materials, specifications & detailing, special attention to foundations, walls, roofs, terraces, floors, doors, windows, plinth, compound walls, expansion joints and staircases to improve maintainability, water supply and sanitary works, termite control, external finishes.

Road stabilization techniques, compaction & drainage, shoulders, slope protection, joints in Cement Concrete Pavements, routine and service maintenance, recycling, bridges and Cross Drainage works repairs, strengthening and rehabilitation, reliability rating of existing structures and systems, service life & expected load carrying capacity, service & stability requirements, future service requirements, loads, fatigue and creep.

[07 Hrs.]

UNIT – 4 :

Materials and Techniques for Maintenance:

Materials for repairs like cement, cement grouts, epoxy grouts, mortars and coatings, polymer concrete composites, sealants, membrane overlays, fiber reinforced concrete, resin based compounds, emulsions, paints and geotextiles, techniques like stiffening, linings, guniting protection systems, prestressing, post-tensioning and base isolation technology, corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, stitching, repair and strengthening of concrete buildings, foundation repair and strengthening, underpinning, leakage of roofs and methods of repair.

Failure of Buildings:

Definition of building failure, functional, structural and aesthetical failures, case studies, methodology of failure investigation, diagnostic testing methods and equipments, effect of fire on buildings.

[06 Hrs.]

VIII SEMESTER

CV1434	PE V: Maintenance & Rehabilitation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

UNIT – 5 :

Maintenance Planning:

In-depth significance of maintenance as opposed to cosmetic treatments, broad action plan, planning, budgeting and controlling the cost of maintenance work, policy formulation, standards of maintenance & controlling cost, planned maintenance, inspection cycles and condition surveys, investigation for assessing condition of structures including non-destructive evolution techniques like proof load test, photogrammetric analysis, assets and optical electric motion analysis, Bovescopesfiber optic probes, chain-dragging, acoustic emission and ultrasonic techniques, infrared thermography, high-speed non-contact sensor, sonar and sound penetrating radar techniques, reliability rating, maintenance cost records, maintenance manuals, their functions, contents and types, difficulties in planned maintenance.

Conservation and Recycling –

Historical buildings, conservation movement (needs), documentation, materials and methods for conservation work, recycling of old building and its advantages, case study.

[07 Hrs.]

UNIT – 6 :

Maintenance Oriented Designs: Design and its relation to maintenance, relationship between initial maintenance and running costs, cost appraisal techniques, consideration of maintenance at design stage, design needs, importance of feedback and feedback systems, information gathering, design data communication, interaction between designers and contractors, maintainability, role of design professionals

Maintenance Management: Need for data, relationship of the data base system to management process, cost of data base and management, uses of data base, problems in data collection, setting criteria from data collected, operational assessment.

Research in Maintenance: Importance of research, areas of research including materials, techniques, field equipment and tools for investigation, repairs and monitoring non-destructive evaluation techniques.

[06 Hrs.]

Text Books:

1. Concrete Technology, 2009, Shetty M.S., S.ChandPublication,New Delhi.
2. Concrete for Construction - Facts and Practice, 1999, Raina V.K, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. SP: 25 -1984 - Hand Book on Causes and Prevention of Cracks in Buildings, 1999, Bureau of Indian Standards, New Delhi.

Reference Books:

1. Concrete - Building Pathology, 2003, Macdonald S., Blackwell Science Limited, Oxford.
2. The Maintenance and Adaptation of Buildings, 1981, Chudley, R., Longman Group Ltd, New York.
3. Corrosion Damaged Concrete - Assessment and Repair, 1987, Strecker, P.P, Butterworths, London.

VIII SEMESTER

CV1455	PE V: Finite Element Method			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. 2. To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. 3. To provide the student with some knowledge in is oparametric formulation. 4. To provide students the knowledge of mathematical modelling techniques.	1. Students will demonstrate an ability to apply the steps required for FEM solution to variety of physical systems. 2. Students will demonstrate an ability to create models for simple structures. 3. Students will be able to extend the knowledge of the application of FE to solve engineering problems.
Mapped Program Outcomes: a, d, e, k,	

UNIT – I :
Introduction: Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.

[07 Hrs.]

UNIT – II :
Shape functions: Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.

[06 Hrs.]

UNIT – III :
Application of FEM to 1D problems: Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.

[06 Hrs.]

UNIT – IV :
Application of FEM to 2D problems: Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.

[07 Hrs.]

UNIT – V :
Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.

[07 Hrs.]

UNIT – VI :
Numerical integration, Modeling, storage and solution techniques.

[06 Hrs.]

Text Books :
1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P. N. , . Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y. M., Eldho T. I. and Shah A. H., Finite Element Method s and Application to Engineerimg, Pearson , 2011.

Reference Books :
1. Krishnamoorthy C S, “Finite Element Analysis – Theory and Programming”, Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, “Concepts and Applications of Finite Element Analysis”, John Weily & sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, “Finite Element Analysis in Engineering Design”. S Chand & Co., 2003.

VIII SEMESTER

CV1456	PE V - Advanced Geotechnical Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance of engineering properties of soil in foundation design. 2. To create an ability to apply knowledge of geotechnical engineering.	1. Students will understand about clay mineralogy. 2. Students will understand the analysis and interpretation of data related to the field of Geotechnical engineering. 3. Students will understand about machine foundations and well foundations.
d Program Outcomes: a, b, e, h, l	

UNIT-1

Clay mineralogy:

Soil as three-phase system. Various soil weight & volume inter–relationship. Soil structure and clay mineralogy: atomic and molecular bonds, inter particle forces in a soil mass, clay minerals, mode of occurrence of water in soil, Effective, neutral and total stresses in soil mass.

[06 Hrs.]

UNIT-2

Shear strength parameters and their applications:

Shear strength parameters of cohesion less and saturated cohesive soils, Principle of effective stress, Stress- Strain relationship, Skempton's Pore pressure coefficients,

Bearing capacity of soils (IS: 6403), types of shear failure in foundation soil, Terzaghi's theory, its validity and limitations, bearing capacity factors, effect of water table on bearing capacity.

[07 Hrs.]

UNIT-3

Stability analysis of slope

Effective and total stress analyses, shape of slip surface, method of slices, graphic methods, location of critical slip circle, wedge analysis.

[07 Hrs.]

UNIT-4

Flow through soils:

Permeability, seepage, mathematical analysis, Finite difference formulae for steady state flow nets –computation of seepage, uplift pressure, and critical hydraulic gradient.

[06 Hrs.]

UNIT-5

Machine Foundation: Introduction, Types of machine foundation, Basic definitions, Degree of freedom of block foundation, General criteria for design of Machine foundation, free & forced vibrations, Vibration analysis of a machine foundation, Determination of natural frequency, foundations for impact loads and vibration isolation.

[07 Hrs.]

UNIT – 6 :

Well foundation : Different shapes of wells, forces acting on the well foundation, Analysis of well foundation, Individual components of well foundation, Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well and grip length.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VIII SEMESTER

CV1457	PE V: Design of Bridge Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand various types of bridges and loadings. 2. Understand seismic behavior of bridges. 3. Understand design philosophy for bridges.	1. Students will understand fundamentals of bridge design. 2. Students will understand analysis and design of various types of bridge decks. 3. Students will understand the Sub-Structure Design and design of various components.
Mapped Program Outcomes: a, b, c, e,h,l	

UNIT – 1 :
Introduction to IRC codes, Loads on bridges and load combinations.
Introduction to elevated rail transit system, grade separation structures, pedestrian crossing and sub- ways.
[06 Hrs.]

UNIT – 2 :
Design of Bridge Slabs: Longitudinally reinforced deck slabs, transversely reinforced bridge slabs.
[07 Hrs.]

UNIT – 3 :
Design of Reinforced Concrete Bridges: Design of T- beam, box girder bridges.
[06 Hrs.]

UNIT – 4 :
Design of Prestressed Concrete Bridges: Design considerations and design examples.
[07 Hrs.]

UNIT – 5 :
Design of bridge bearings, types of bridge bearings, design examples.
[05 Hrs.]

UNIT – 6 :
Sub-Structure Design: Foundation investigation, bridge pier design, abutment design, open foundation, pile foundation.
[08 Hrs.]

Text Books:
1. T.R. Jagadeesh, M.A. Jayaram, Design of Bridge Structure, PHI publication.
2. Krishnaraju „ Bridge Engineering, UPD Publishers, New Delhi,2000.
3. Baider Bakht and Leslie, G. Jaeger,‘ Bridge Analysis Simplied, Mcgraw Hill Book Co,1998.

Reference Books:
1. IRC 005, Standard Specifications and Code of Practice for Road Bridges, Section I (General Features of Design) (Seventh Revision), 1998.
2. IRC 006, Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fourth Revision), 2014.
3. IRC 078, Standard Specifications and Code of Practice for Road Bridges, Section VII – Foundations and Substructure (Revised Revision), 2014.
4. IRC 083-1, Standard Specifications and Code of Practice for Road Bridges, Section IX (Bearings), Part I (Metallic Bearings) (First Revision), 1999.
5. IRC 112, Code of Practice for Concrete Road Bridges, 2011.
6. Johnson Victor, ‘Bridge Engineering’, Oxford IBH, New Delhi, 2000.
7. Raina, R.K, ‘Principles of Design of RCC Bridges, Tata McGraw Hill,1999.
8. Conrad P. Heins and Richard A. Lawrie, ‘Design of Modern Concrete Highway Bridges, John Wiley and Sons, 1999.

VIII SEMESTER

CV1458	PE V – Advanced Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various theories and design of regarding shallow foundations. 2. To familiarize students with geotechnical design of Deep foundations. 3. To acquaint students with criteria for design of Machine foundation.	1. An ability to understand various approaches of determining bearing capacity shallow foundation. 2. An ability to predict and calculate settlement of foundation. 3. An ability to design deep and machine foundations
Program Outcomes: a,c,e,f,g,h,i,j,k,l	

UNIT-1

Bearing Capacity of Foundations: Terzaghi's, Meyerhoff, Hansens bearing capacity theories, Bearing capacity based on SPT, SPT Correlations, Design N Values, Bearing Capacity of Foundations with Uplift or Tension Forces, layered soils, eccentric and inclined loads, Bearing capacity on slopes, Safety Factors in Foundation Design,

[07 Hrs.]

UNIT-2

Foundation Settlements:

The Settlement Problem, Stresses in Soil Mass Due to Footing Pressure, Immediate Settlement Computations, Alternative Methods of Computing Elastic Settlements, Stresses and Methods of Computing.

[06 Hrs.]

UNIT-3

Combined and Mat Footing:

Safe bearing pressures for mat foundations on Sand and clay, Eccentric Loading, The Coefficient of Subgrade, Proportioning of Cantilever Footing, Design of Combined Footings by Rigid Method (Conventional) Method, Design of Mat Foundation by Rigid Method, Design of Combined Footings by Elastic Line Method, Design of Mat Foundations by Elastic Plate Method, Floating Foundation.

[07 Hrs.]

UNIT-4

Vertically Loaded Pile: Design of pile foundation: Ultimate Bearing Capacity in Cohesionless Soils, Critical Depth, Static Bearing Capacity of Piles in Clay Soil, Bearing Capacity of Piles in Granular Soils Based on SPT Value, Bearing Capacity of Piles Based on Static Cone Penetration Test (CPT),

Pile group : Settlement of pile groups in sand, settlement of pile groups in cohesive soils, allowable loads on groups of piles, uplift capacity of a pile group, behavior of laterally loaded, Winkler's hypothesis, *p-y* curves for the solution of laterally loaded piles

[06 Hrs.]

UNIT-5

Machine Foundation: Introduction, Types of machine foundation, Basic definitions, Degree of freedom of block foundation, General criteria for design of Machine foundation, free & forced vibrations, Vibration analysis of a machine foundation, Determination of natural frequency, foundations for impact loads and vibration isolation.

[07 Hrs.]

UNIT – 6:

Well foundation: Different shapes of wells, forces acting on the well foundation, Analysis of well foundation, Individual components of well foundation, Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well and grip length.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.
2. Principles of Foundation Engineering: Das B.M., PWS publishing co., (1999)
3. Foundation Analysis & Design: Bowles J.E., McGraw Hill, (1996)
4. Shallow Foundation: Das B.M., CRC Press, (2009)

VIII SEMESTER

CV1424	**Comprehensive Viva-Voce**			**L=0**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	**----**	**----**	**100**		**100**	**---**

COURSE OBJECTIVES	COURSE OUTCOME
1. To understand necessity to study a topic comprehensively. 2. To know various ways and means to collect data and technical information related to a topic. 3. To understand ways to present literature collected.	1. An ability to collect information regarding only topic related in civil engineering 2. An ability to present the information collected in the expected format 3. An ability to express and communicate about the information collected.
Mapped Program Outcomes: b, c, e, i	

Every student will be allotted a specific topic related to civil engineering with the consent of the student. The student will be expected to prepare a detailed note on the topic and submit it to the guide. Evaluation will be based on the extent of information provided by the student and viva voce conducted by a panel of experts constituted by the department.

Operative Procedure for Comprehensive Viva Voce.

1] At the beginning of VIII Semester every faculty member in the Department (Regular and MR) will contribute at least *FIVE* sub-topics falling within the purview of UG Syllabus for preparing presentation during Comprehensive Viva-Voce. It should be seen that not more than 5 minute presentation shall be required to deal with the sub-topic.

2] A committee consisting of HoD and Five Senior Faculty Members shall go through the compiled list of sub-topics and finalise the list for onward processing.

3] The topic shall be allotted to each student from within the finalized list randomly and shall asked to prepare a presentation of FIVE minutes (5- 10 slides) for comprehensive viva voce with the help of their project guide.

4] The evaluation of the comprehensive viva voce shall be carried out not on the basis of the presentation of the topic, but on the basis of how the student have answered the questions arising out of the presentation and it's relevance to the General Civil Engineering.

5] The evaluation of the comprehensive viva voce shall be done by a panel of experts and be more in the context of overall understanding of Civil Engineering Syllabus rather than the topic of the presentation.

VIII SEMESTER

CV1425	**Project – Phase--II**			**L=0**	**T=0**	**P= 8**	**CREDITS = 8**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	**----**	**40**	**60**		**100**	**---**

COURSE OBJECTIVES	**COURSE OUTCOME**
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.	1. An ability to apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.
2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.	2. An ability to designed a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interprete the data.
3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.	3. An ability to work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.
4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	4. An ability to apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.
5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	5. An ability to analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.
Mapped Program Outcomes: a,b,c,d, e,f, g,h, I,,j, k,l,m,n	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII SEMESTER

CV1426	**Extra / Co-Curricular / Competitive Examination**			**L=0**	**T=0**	**P=0**	**CREDITS = 2**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	**----**	**100**	**----**		**100**	**---**

COURSE OBJECTIVES	**COURSE OUTCOME**
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develope creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to develop team work, leadership qualities, competitive spirit. 2. An ability to develop thinking and analysis process for environmental, ethical society. 3. An ability to develop solution to engineering problems related with social, environmental and ethical issues. 4. An ability to develop and nurture soft and communications skills.
Mapped Program Outcomes:a, b, h, j, k	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.