CIVIL ENGINEERING
Session 2021-22

School of Studies in Engineering & Technology

GURUGHASIDAS VISHWAVIDYALAYA
(A Central University Established by the University Act 2009)
BILASPUR, C.G. 495009

COURSES OFFERED BY THE DEPARTMENT

Sl. No.	Courses	Annual Intake	Duration of Course(years)
1	B.Tech.	50	4
2	M. Tech.	23	2
3	Ph.D.	25	-

Civil Engineering Department

Programme Outcomes (POs)

Engineering Graduates will be able to :

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

Programme Specific Outcomes (PSOs

PSO1	Graduates will be able to solve the problems related to structural engineering, geotechnical engineering, construction management, transportation engineering, irrigation engineering and environmental engineering by applying the knowledge of mathematical and physical sciences.
PSO2	Graduates will be able handle and apply the technology, modern engineering tools and equipment, software, remote sensing and GIS techniques to solve the problems in the field of civil engineering.
PSO3	Graduates are capable of working in groups by undergoing summer internship in the industry and in laboratories and carrying out minor and major project works.

Scheme & Syllabus
(IInd Year)
B.Tech.
(Civil Engineering)
III-SEM. to IV-SEM.

S.No.	Course No.	Subject	Periods			Evaluation Scheme			Credits
		Theory	L	T	P	IA*	ESE	Total	
1	CE 203TBS05	Engineering Mathematics-III	3	1	0	30	70	100	4
2	CE203TPC01	Strength of Materials	3	1	0	30	70	100	4
3	CE203TPC02	Fluid Mechanics-I	3	0	0	30	70	100	3
4	CE203TPC03	Building Materials & Construction	3	0	0	30	70	100	3
5	CE203TPC04	Surveying & Geomatics	3	0	0	30	70	100	3
6	CE203THS03	Professional Practice, Law & Ethics	2	0	0	30	70	100	2
Practicals									
1	CE203PPC01	Survey Lab	0	0	2	30	20	50	1
2	CE203PPC02	Fluid Mechanics Lab	0	0	2	30	20	50	1
		TOTAL					Total Credits		21

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam;

SCHEME OF B.TECH. IV SEMESTER CIVIL ENGINEERING (New CBCS)
W.E.F. 2021-22 (EVEN SEMESTER)

S.No.	Course No.	Subject	Periods			Evaluation Scheme			Credits
		Theory	L	T	P	IA*	ESE	Total	
1	CE204TPC05	Engineering Economics	3	1	0	30	70	100	3
2	CE204TPC06	Concrete Technology	3	1	0	30	70	100	3
3	CE204TPC07	Structural Analysis-I	3	0	0	30	70	100	4
4	CE204TPC08	Fluid Mechanics-II	3	0	0	30	70	100	3
5	CE 204THS02	Effective Technical Communication	3	0	0	30	70	100	3
6	CE204TMC02	Management (Organizational Behaviour)	2	0	0	-	-	-	0
Practicals									
1	CE204PES06	Computer Aided Civil Engg. Drawing	0	0	2	30	20	50	1
2	CE204PPC03	Material Testing Lab	0	0	2	30	20	50	1
3	CE204PHS01	Effective Technical communication lab	0	0	2	30	20	50	1
		TOTAL					Total Credits		19

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam;

SYLLABUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE203TPC01	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	Strength of Materials	3	1	-	15	15	30			

Course Objectives:
The objective of this Course is to:

- To develop understanding of mechanical properties to compute response in the material (Stress and Strain) using analytical and graphical method.To apply the fundamentals of simple stresses and strains.
- To analysis the structural element (Beam) for different loading condition to obtain design parameters (BM, SF, Slope and Deflection)
- To determine and study stress variation in beams using conceptual theories.
- To learn engineering principles for understanding the behavior of compression member.
- To study theory of torsion in solid and hollow shaft and stresses developed in cylindrical shells.

Course Content:
UNIT-1: Simple Stresses -Strain and compound stresses: Types of stresses and strains, Mechanicals properties, Hooke's law, stress– strain curve for mild & Cast iron, hardness, impact strength, Poisson's ratio, Relation between the elastic moduli & Poisson's ratio, Bars subjected to varying loads, Temperature stresses in composite bars, Elongation of bars of constant and varying sections. Stress at a point. Components of stress in rectangular coordinates, stresses on an inclined plane, Principal stresses & principle plane, Mohr's circle of stresses.
UNIT-2: Shear Force - Bending Moment: Shear Force & Bending Moment diagrams in statically determinate beams loaded with different load combination, Relationship between Load intensity- Shear Force - Bending Moment, Thrust diagram, Point of contra flexure, loading diagram & Bending moment diagram from shear force diagram, beam with internal hinge. Bending Stress.
UNIT-3: Shear Stresses in Beams Derivation of Shear Stress formula, assumptions, and Shear stresses in symmetrical elastic beam with different sections. Slope and Deflections of simple Beams: Derivation of differential equation for deflection, Slope & Deflection of Beams by Double integration method, Macaulay's method & Moment area method.
UNIT -4: Torsion: Equation of Pure Torsion, Assumptions, and Power transmitted, Stiffness of Shafts, Comparison of Solid & Hollow shaft, Strain energy in Torsion. Columns: Stable and unstable equilibrium, Short columns, Euler's formula for long columns, Equivalent length, Limitation of Euler's formula, Rankine's formula.
UNIT -5: Thin-walled pressure vessels: Cylindrical pressure vessels, Spherical vessels. Thick Cylindrical vessels: Lame's theory, Graphical method for determining stresses Spherical shells.

Text Books:
1.Strength of Materials – R.K. Rajput (S. Chand & Co.)
2.Strength of Materials – R.K. Bansal (Laxmi Publication)
3.Strength of Materials – S.S Ratnam (Tata McGraw Hill)
4.Strength of Materials – Timoshenko, S. & Gere (CBS Publishers)
5.Introductions to Solid Mechanics –Shames &Pitarresi (Prentice Hall of India)
6.Strength of Materials–S. Ramamurtham (DhanpatRai Publications)

Course Outcomes- At the end of the course the students will be able to:
CO1   Describemechanical properties of material (stress & strain) in two dimensional systems by analytical and graphical method.
CO2   Analyze structural member (beams) to evaluate behavioural response (BM, SF, Slop, Deflection) for various loading condition.
CO3   Estimatetorsional stress in solid and hollow shaft.Analyse various situations involving structural members subjected to bending, shear and torsion.
CO4   Characterize and analyzethe types of columnon the basis of engineering theories.
CO5   Evaluatestresses variation in thin and thick cylindrical shells.

.Course Outcomes and their mapping with Programme Outcomes : Strength of Materials (CE203TPC01)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE203TPC02	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Fluid Mechanics- I	3	-	-	15	15	30			

Course Objectives:

- To introduce and give explanation of fundamentals of Fluid Mechanics and give fundamental knowledge of fluid with its properties, behaviour, forces on various surfaces and stability of submerged and floating body.
- To develop understanding about Kinematics of fluid flow.
- To imbibe basic law of energy and equation used for analysis of dynamic fluids.
- To introduce the importance of fluid Flow in Pipes and determine the losses in a flow system.
- To develop understanding aboutflow through mouthpieces and orifices.

Course Content:

UNIT-1: Introduction: Fluid, physical properties of fluids ideal and real fluid, Newtonian and Non-Newtonian Fluid Statics: Pressure density height relationship, pressure measurement by Manometers, Pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, metacentric height.

UNIT-2: Kinematics of fluid flow : Steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, one, two and three dimensional flow, streamlines and path lines, rotational and irrotational flow, continuity equation, three dimensional continuity equation. Velocity potential and stream function.

UNIT-3: Dynamics of fluid flow: Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications – Pitot tube, Venturimeter, orificemeter, and problems related to application of momentum equations.

UNIT-4: Flow in Pipes: Major and minor losses in pipe lines, loss due to sudden contraction & expansion, Pipes in series and parallel Flow in open Channel: Comparison between open channel and pipe flow, definition of uniform and non-uniform flow, Chezy's and Manning's Formula, Hydraulically efficient channel section of rectangular, trapezoidal.

UNIT -5: Flow through mouthpieces and orifices: Hydraulic coefficients of orifice, flow through large rectangular orifice, mouthpieces, Borda's mouthpieces. Notches and Weirs: Rectangular, triangular and trapezoidal notches and weir, cippoletti and broad crested weir.

Name of Text Books:
1. Fluid Mechanics and Machines – Dr. A.K. Jain (Khanna Publications)
2. Fluid Mechanics and Machines – Dr. R.K. Bansal (Laxmi Publications)
3. Fluid Mechanics & Hydraulic Machines – Dr.P.N.Modi&S.M.Seth,(Narosa Publishing House)

Name of Reference Books:
1. Mechanics of Fluid – Irving H. Shames (McGraw Hill)
2. Introduction to Fluid Mechanics – James A. Fay (Prentice Hall India)
3. Fluid Mechanics – R.J. Garde (New Age International Publication)
4. Fluid Mechanics – Streeter V.L. & Wylie E.B. (Tata McGraw Hills)
5. Fluid Mechanics – John F Dougles (Pearson Publication)
6. Introduction to Fluid Mechanics Fox, R.W. and McDonald, A.T., John Wiley & Sons.
7. Fluid Mechanics", Streeter, V.L. and Benjamin, W.E., "McGraw-Hill.
8. Fluid Mechanics and Fluid Mechanics Som, S.K. and Biswas, G., Tata McGraw Hill.
9. Introduction to Fluid Mechanics, Fox, R. W. and A. T. McDonald, 6th ed., John Wiley, New York, (2004)

Course Outcomes- At the end of the course students will be able to

CO1 Define fluid properties and state the Newton's law of viscosity with explain the mechanics of fluid at rest
CO2 Describe the Kinematics of fluid flow.
CO3 Employ Bernoulli's equation for ideal and real fluid flow and deduce expressions for Venturimeter, orifice meter and pitot tube.
CO4 Explain the concept of Flow in Pipes and types of losses in pipe flow.
CO5 Describe Flow through mouthpieces &orifices and distinguish it.

Course Outcomes and their mapping with Programme Outcomes Fluid Mechanics- I (CE203TPC02)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE203TPC03	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Building Materials & Construction	3	-	-	15	15	30			

Course Objectives:
- To introduce the basic engineering properties of building materials like brick, stones, timber, ceramics, plastics, etc.
- To understand the elementary characteristics of construction materials like cement aggregates, concrete, steel, etc.
- To understand the types of foundations, functions, types of masonry, lintels, etc.
- To learn the structure supporting method like Shoring, Underpinning, and other advanced construction materials & Techniques.

Course Content:

UNIT- 1: Stones, Bricks, Tiles, Timber; Properties, Classification &Uses

UNIT-2: Miscellaneous Engineering Materials; Ceramics & glass; Plastics & Rubber; Paints, Varnishes and distempers; Composite materials; Adhesives; Thermal, Electrical & Sound Insulators.

UNIT 3: Cement, Aggregate, Concrete and Steel; classification, properties & uses.

UNIT-4: Foundations, Masonry, Arches & Lintels; Classification, Requirements & Uses.

UNIT-5: Shoring, Underpinning, Formwork, Advanced construction materials & Techniques.
    The relevant IS Codes for all the materials and NBC.

Name of Text Books:
1. Building Materials – S.K. Duggal (New Age Publication)
2. Building Materials – S. C. Rangwala (Charotar Publication)
3. Building Construction by S.G. Rangwala, Charter Publishing House, Anand, India.
4. Building Construction by Sushil Kumar, Standard Publ. and Distributors, New Delhi
5. Building Construction by Punmia B.C., Lakshmi Publications, New Delhi.
6. Advanced Building Materials and Construction by Mohan Rai and Jai Sing, CBRI Publications, Roorkee
7. Concrete Technology – A.M. Neville & J.J. Brooks (Pearson Education)
8. Concrete Technology – M.S. Shetty (S. Chand & Co.)
9. Engineering Materials – Surendra Singh (Laxmi Publication)
10. Construction Engineering and Management – S. Seetharaman (UmeshPublication)
11. Building Materials – Gurucharan Singh (Standard Publishers, Delhi

Course Outcomes:
At the end of the course the students shall be able
CO1   To compare the properties of most common and advanced building materials.
CO2   To understand the typical and potential applications of these materials
CO3   To select the appropriate building material for building construction
CO4   To identify the different components of a building and differentiate various types of foundations, masonry, arches and lintels
CO5   To select the appropriate supporting structure for strengthening of the building

Course Outcomes and their mapping with Programme Outcomes: Building Materials & Construction (CE203TPC03)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-III)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject Code:	CE203TPC04	3	-	-	15	15	30			
Subject:	Surveying & Geomatics									

Course Objectives:
- To understand the Concepts of levelling & its application on the field.
- To learn about the concepts of theodolites, tacheometry & triangulation.
- To understand subsidiary surveying like photographic & hydrographic surveying.
- To learn to apply advanced application of surveying like Remote sensing, EDM.

Course Content:

Unit 1: Levelling & Contouring:Temporary and permanent adjustment of levels. Sensitivity of bubble tube, Levelling staff, Types of levelling: - Reciprocal, Profile, Differential, Plotting of profiles Correction: - curvature and refraction.
Contouring: definitions, contour interval, equivalent, uses and characteristics of contour lines, direct and indirect methods of contouring.

Unit 2: Theodolite and Tacheometry: Vernier theodolites, Temporary and permanent adjustments, Requirements of nonadjustable parts, Measurement of horizontal angle by repetition and reiteration method, Measurement of vertical angles.
TACHEOMETERY: Definitions, Principles of stadia systems. Instrument constants, Substance and Tangential Systems. Construction and use of Reduction Tacheometers.

Unit 3: Triangulation: Principle and classification of Triangulation System, Strength of Figures, Station marks and Signals, Satellite station, intersected and Resected points.
Plane Table Surveying: Principles, Advantages and disadvantages, Plane table equipment, Use of Telescopic Alidade, Different methods of Plane Table Surveying. Area and volume measurements

Unit 4: Photographic& Hydrographic Surveying: Photo theodolite, principle of the method of terrestrial photogrammetry, scale and distortion of the vertical and tilted photograph.
HYDROGRAPHIC SURVEYING: Introduction, shore line survey, soundings methods

Unit 5: (A) Principle of Electronic Distance Measurement:Principle, Type, Use, Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications.
(B) Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors, Introduction to GPS

Text/Reference Books:
1. B.C Punamia, A.K Jain, Surveying Vol. 1 & 2, Laxmi Publications.
2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011

Course Outcomes-
At the end of the course students will be able to:
CO1 Remember concepts, techniques, basics, and instruments of the discipline to engineering and surveying activities
CO2 Understandvarious methods and Application of levelling
CO3 Understand the working principles of various surveying instruments
CO4 Apply the knowledge of Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

Course Outcomes and their mapping with Programme Outcomes: Surveying & Geomatics (CE203TPC04)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		2								3	3	3
CO2	2	1	2	1					1				2	2	3
CO3	3		3	2	3							2	2	3	1
CO4	3	3	3	2								2	2	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	02
Subject Code:	CE203THS03	2	-	-	15	15	30			
Subject:	Professional Practice, Law & Ethics									

Course Objectives:
- To know about roles of various stakeholders in formulating standards of practice and to learn about ethical values in professionalism.
- To study general principles of contracts management and practice involvingtender proposal.
- To understand ADR mechanism like arbitration, conciliation, Lok Adalat in judicial system.
- To learn legal aspect of labour engagement and other construction related law in civil engineering.
- To understand lawand policy related to Intellectual property,Copyright, Trademarks, Patents and Piracy

Course Content

UNIT 1:Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards).Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

UNIT 2:General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Term.

UNIT 3:Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT 4:Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piecerate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

UNIT 5: Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

Text Book/ References:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. The National Building Code, BIS, 2017
3. RERA Act, 2017
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R. (1979), Law of Contract, Oxford University Press
9. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
11. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
12. Bare text (2005), Right to Information Act
13. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
14. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
15. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
16. Vee, Charles &Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp117-127, MCB UP Ltd
17. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
18. Ethics in Engineering- M.W.Martin&R.Schinzinger, McGraw-Hill
19. Engineering Ethics, National Institute for Engineering Ethics, USA
20 Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
22. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm
23. Internet and Business Handbook, Chap 4, CONTRACTS LAW, http://www.laderapress.com/laderapress/contractslaw1.html
24. Contract&Agreements http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
25. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
26. Business & Personal Law. Chapter 7. "How Contracts Arise", http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
27. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
28. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, http://www.worldbank.org/html/opr/consult/guidetxt/types.html
29. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf

Course Outcomes:

At the end of the course student will be able

CO1	To describe respective roles of regulatory bodies and ethical practice to be followed by engineering professionals.
CO2	To define principle of tender filing and contract management.
CO3	To distinguish between ADR mechanism and formal judicial proceedings for dispute resolution.
CO4	To explain role of labour and other construction-related laws in civil engineering.
CO5	To identify law and policy related to Intellectual property, Copyright, Trademarks, Patents and Piracy.

Course Outcomes and their mapping with Programme Outcomes: Professional Practice, Law & Ethics (CE203THS03)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
Subject Code:	CE203PPC01	L	T	P	IA	TOTAL	20	50	01
Subject:	Survey Lab	0	0	2	30	30			

Course Objectives:
The Lab sessions would help in learning:

- Applications of chains & compass in surveying.
- Various Applications of levelling process.
- Use of Plane table surveying in preparing of maps of a location
- Tacheometry & its applications.
- Relative adjustment of non- accessible stations
- Principle & operation of Total Station.

Course Content:
List of experiments:

1. Linear measurement, offsetting & Determination of the area of the given field by cross staff survey & metric chain.
2. Compass open & closed traversing using prismatic compass and elimination of local attraction. 3. To find the difference in elevation between the two non-invisible stations by the method of differential levelling.
3. To draw longitudinal & cross-sectional profile of the road by the method of profile levelling.
4. Measurement of horizontal angle by repetition & reiteration method.
5. Traversing of the given area by radiation & intersection method using plane table survey. 7. Find the plane table instrument station using Resection method (Two-point problem & three-point problem)
6. Determination of Tacheometric constants (K & C).
7. Determination of elevation and height by tangential method when both angles are angles of elevation.
8. Determination of elevation and distance when line of sight inclined Upward & Downward
9. To perform the experiment for reduction to center from different positions of a satellite station when: (i) Satellite station in north position, (ii) Satellite station in left position
10. To perform the experiment for reduction to centre from different positions of a satellite station when: (i) Satellite station in south position, (ii) Satellite station in right position
11. Study of total station

Text Book:
  1.Surveying and Leveling. N.N.Basak, 1st Edition, Tata McGraw Hill
  2.Surveying (Vol. I & II) – Punmia, B.C. (Laxmi Publications, New Delhi, 1996)
  3.Surveying (Vol. I & II) – Kanetkar (Pune VidyarthiGrihaPrakashan, Pune)
Reference Books:
  1. Surveying (Vol. II & III) – Agor, R (Khanna publications, Delhi, 1995)
  2. Surveying (Vol. II & III) – Arora, K.R. (Standard Book House, Delhi, 1993)
  3. Surveying (Vol. I & II) – S.K. Duggal (Tata McGraw Hill)

Course Outcomes-
On completion of the course, the students will be able to:
CO1   Remember about conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling.
CO2   Understand &apply the procedures involved in field work and to work as a surveying team.
CO3   Design a Plan of survey appropriately with the skill to understand the surroundings.
CO4   Apply concepts of accurate measurements techniques, field booking, plotting and adjustment of errors.

Course Outcomes and their mapping with Programme Outcomes: Survey Lab (CE203PPC01)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	3								3	3	1
CO2	2	1	2	3	2								2	3	2
CO3	3	2	3	3	1							2	2	1	1
CO4	3	3	1	1	3								1	2	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
		L	T	P	IA	TOTAL	20	50	01
Subject Code:	CE203PPC02	0	0	2	30	30			
Subject:	Fluid Mechanics Lab								

Course Learning Objectives:
- To understand the verification of bernoulli's equation.
- Determination ofMeta centric height of ship model
- Calibration of flow measuring devices as Venturimeter
- Calibration of flow measuring devices as Orificemeter.
- Demonstrate and find out co-efficient of velocity for orifice and Mouthpiece.
- Demonstrate and find out co-efficient of discharge for various types notches.
- Determination of friction factor for pipes
- Determination of critical velocity in pipe
- Determination ofthe co-efficient of pitot tube.
- Determination of coefficient of impact for vanes
- To plot velocity profile across the cross section of pipe
- Determine the Reynold's Number in pipe.
- To learn the Calibration of rectangular sharp cornered weir and to study the pressure distribution on the upstream face of the weir.
- To learn the Calibration of rectangular streamlined weir and to study the pressure distribution on the upstream face of the weir.

Course Content:
List of experiments:
1. To calculate the total energy at different points and plot the graph between total energy vs. distance.
(Verification of Bernoulli's equation)
2. To determine the Meta centric height with angle of ship model.
3. To determine the co-efficient of Discharge Cd for Venturimeter
4. To determine the co-efficient of Discharge Cd for Orificemeter.
5. To determine the co-efficient of discharge and the co-efficient of velocity for Orifice.
6. To determine the co-efficient of discharge and the co-efficient of velocity for Mouthpiece.
7. To determine the coefficient of discharge Cd of Rectangular Notch.
8. To determine the coefficient of discharge Cd V Notch - 45^0
9. To determine the coefficient of discharge Cd V Notch - 60^0
10. To determine the friction factor for Darcy-Weisbach equation
11. Experimental determination of critical velocity in pipe.
12. To determine the coefficient of impact for vanes
13. To find the co-efficient of pitot tube
14. To plot velocity profile across the cross section of pipe
15. To determine the Reynold's Number in pipe
16. Calibration of rectangular sharp cornered weir and to study the pressure distribution on the upstream face of the weir.
17. Calibration of rectangular streamlined weir and to study the pressure distribution on the upstream face of the weir.

CourseOutcomes-At the end of the course students will be able to
CO1   Verification of basic principles energy (Bernoulli's equation).
CO2   Utilization of basic measurement techniques of fluid flow in Venturimeter.
CO3   Utilization of basic measurement techniques of fluid flow in Orificemete.
CO4   Gaining knowledge to calculate co-efficient of velocity for orifice and Mouthpiece
CO5   Gaining knowledge to calculate co-efficient of discharge for various types notches
CO6   Experimental determination of critical velocity in pipe.

CO7   Understanding of analyzing pipe flow systems and its losses.
CO8   The ability to determine the coefficient of impact for vanes.
CO9   The ability to determine co-efficient of discharge for pitot tube
CO10   To plot velocity profile across the cross section of pipe
CO11   The ability to determine the Reynold's Number in pipe
CO12   The ability to Calibration of rectangular sharp cornered weir and to study the pressure distribution on the upstream face of the weir.
CO13   The ability to Calibration of rectangular streamlined weir and to study the pressure distribution on the upstream face of the weir..

Course Outcomes and their mapping with Programme Outcomes: Fluid Mechanics Lab (CE203PPC02)

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	1								3	2	2
CO2	3	3	3	2	1								3	2	2
CO3	3	3	2	2	1								3	2	2
CO4	3	3	2	2	1								3	2	2
CO5	3	3	2	2	1								3	2	2
CO6	3	3	3	2	1								3	2	2
CO7	3	3	3	2	1								3	2	2
CO8	3	3	2	2	1								3	2	2
CO9	3	3	3	2	1								3	2	2
CO10	3	3	2	2	1								3	2	2
CO11	3	3	3	2	1								3	2	2
CO12	3	3	2	2	1								3	2	2
CO13	2	2	3	2	1								3	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject Code:	CE204TPC05	3	-	-	15	15	30			
Subject:	ENGINEERING ECONOMICS									

Course Objectives:
1. To learn about the basics of economics and elements of cost in engineering
2. To study about the value engineering and interest formulae
3. To understand various alternative methods of cost comparison analysis
4. To know about replacement and maintenance involved in engineering components.
5. To understand depreciation of a product.

Course Content:
UNIT 1:Introduction to Economics :Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT 2:Value Engineering :Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factorequal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT 3:Cash Flow:Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT 4:Replacement and Maintenance Analysis :Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT 5:`Depreciation:Depreciation- Introduction, Straight line method of depreciation, declining balance `method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TEXT BOOKS:
1. Panneer Selvam, R, ―Engineering Economics‖, Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, ― Managerial economics‖, Oxford university press 2006.
3. Chan S.Park, ―Contemporary Engineering Economics‖, Prentice Hall of India, 2002.

Course Outcome:At the end of the course studentsshall be able to:
CO1 Explain the basics of engineering economics and elements of costs.
CO2 Describe value engineering and can make use of various interest formulae for real life computations
CO3 Observe and identify the best alternative for cost comparison
CO4 Determine between replacement and maintenance needed by an asset.
CO5 Compute the depreciation cost and determine the economic life of a product.

Course Outcomes and their mapping with Programme Outcomes: ENGINEERING ECONOMICS
(CE204TPC05)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE204TPC06	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Concrete Technology	3	-	-	15	15	30			

Course Objectives:
- To learn about various ingredients materials of concrete, like cement aggregates, water, etc
- To understand the role of various Admixtures added to concrete mixes
- To design various grades of concrete as per IS method.
- To understand the various testing methods for fresh & hardened properties of concrete.
- To learn about various special application concretes.

Course Content:

Unit 1: Constituent Material:Cement-Types-Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS grading requirements- Water- Quality of water for use in concrete.

Unit 2: Chemical and Mineral Admixtures :Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers – Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaolin -Their effects on concrete properties

Unit 3: Proportioning of Concrete Mix :Principles of Mix Proportioning-Properties of concrete related to Mix Design Physical properties of materials required for Mix Design – Design Mix and Nominal Mix-BIS Method of Mix Design – Mix Design Examples

Unit 4: Fresh and Hardened Properties of Concrete: Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS – Properties of Hardened Concrete-Determination of Compressive and Flexural Strength-Stress-strain curve for concrete Determination of Young's Modulus.

Unit 5: Special Concretes:Light weight concretes – High strength concrete – Fibre reinforced concrete – Ferrocement – Ready mix concrete – Slurry infiltrated fibrous concrete (IFCON) - Shotcrete – Polymer concrete – High performance concrete- Geopolymer Concrete.

Text Books:
1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
3. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007
4. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
5. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
6. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.

Course Outcomes:
At the end of the course students will be able to:
CO1   Remember & understand properties and role of ingredients like cement, aggregate, admixtures etc. to produce better quality concrete.
CO2   Understand various classification & role of admixtures on properties of concrete.
CO3   Apply design concepts (as per IS method) to design various grades of concrete as per requirement.
CO4   Demonstrate destructive, semi-destructive and non-destructive tests for concrete.
CO5   Understand about various special application concretes.

Course Outcomes and their mapping with Programme Outcomes:Concrete Technology (CE204TPC06)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE204TPC07	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	Structural Analysis-I	3	1	-	15	15	30			

Course Objectives:
- To study the strain energy principles and their application tobeams and pin joint plane frames
- To learn about analysis of arches &cables.
- To know how to construct the influence line diagrams for determinate beams and its application to estimate the maximum shear force, bending moment at a section and absolute maximum bending moment in the beams.
- To study the construction of influence lines for determinate trusses and three hinged arches and its applications.
- To learn about the static indeterminacy of structures and methods of analysis, application of three moment theorem to beams

Course Content:

UNIT 1: Principle of superposition, virtual work principle, Maxwell reciprocal theorem, deflection of beams using conjugate beam method. Deflection of beams and truss using energy method (Castigliano theorem), Analysis of plane truss using tension coefficient method (determinate).

UNIT 2: Three-hinged Arches: Bending Moment, Shear force, axial force for three-hinged arches, Analysis of Suspension Bridge without stiffening girders.

UNIT 3: Influence Lines: Basic concept of moving load and influence line; influence lines for reactions, Shear force and bending moment for determinate beams; absolute maximum shearing force and bending moment.

UNIT4: Influence lines for three-hinged arches and stresses in simply supported plane determinate trusses.

UNIT 5: Static and kinematic indeterminacy of structure, Method of structural analysis, Analysis of fixed beam, continuous beam using Theorem of three moments, Effect of yielding of supports.

Reference Book:
1. Structural Analysis by Devdas Meenon
2. Fundamental of Structural Analysis by Lee.
3. Elementary structural Analysis by A.K. Jain
4. Advanced Structural Analysis by A. K. Jain
5. Structural Analysis (SI units) by R C hibbeler
6. Structural Analysis by L S nagi & R S Jangid

Course Outcomes:
At the end of the course the students will be able
CO1   To apply the concept of conjugate beam and strain energy methods to estimate the deflections of determinate beams and trusses
CO2   To able to analysis three hinged arches and cables.
CO3   To construct and use the influence lines for estimation of different force functions in determinate beams
CO4   To able to draw the ILDs for reactions and internal forces in three hinged arches and determinate trusses and find their values
CO5   To differentiate the determinate and indeterminate structures and apply the three-moment area theorem for the analysis of continuous beams and fixed beams

Course Outcomes and their mapping with Programme Outcomes: Structural Analysis-I (CE204TPC07)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	2							3	1	1	
CO 2	3	3	3	1	2							3	2	1	
CO 3	3	3	2	2	3							3	2	1	
CO 4	3	3	2	2	3							3	2	1	
CO 5	3	3	2	1	2							3	2	1	

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE204TPC08	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Fluid Mechanics-II	3	-	-	15	15	30			

Course Objectives:
- To introduce and give explanation of fundamentals of turbulent flow in pipe.
- To develop understanding about Boundary layer Analysis.
- To develop understanding about non-uniform flow in open channel.
- To introduce the importance of Compressibility effect in pipe flow.
- To develop understanding aboutHydraulic Machines.

Course Content:
UNIT 1: Turbulent flow in pipe: Nature of turbulence, free and wall turbulence, turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, Colebrook-White equation, Moody's diagram, Explicit equation for friction factors.

UNIT 2: Boundary layer Analysis: Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, turbulent boundary layer, and laminar sub layer, Application of momentum equation, local and average friction coefficient. Fluid flow past submerged bodies. Drag and lift, drag on sphere and cylinder Magnus effect.

UNIT 3: Non-uniform flow in open channel: Specific energy, critical flow, analysis of flow over hump and transition, equation of gradually varied flow, hydraulic jump and evaluation of its elements in rectangular channel.

UNIT 4: Compressibility effect in pipe flow: Transmission of pressure waves in rigid and elastic pipes, water hammer Dimensional analysis and Hydraulic similitude. Dimensional analysis, Buckingham's theorem, important dimensionless numbers and their significances, geometric, kinematics and dynamic similarity, model study.

UNIT 5: Hydraulic Machines: Turbines: Classification of turbines, draft tube, specific speed, unit quantities, and characteristics curves of turbines, and governing of turbine. Pump: Introduction, Centrifugal pumps, efficiencies, specific speed, cavitations, slip, percentage slip.

Name of Text Books:
 1.Fluid Mechanics and Machines – Dr. A.K. Jain (Khanna Publications)
 2.Fluid Mechanics and Machines – Dr. R.K. Bansal (Laxmi Publications)
 3.Fluid Mechanics – Dr. P.N. Modi (Standard Book House)
 4.Mechanics of Fluid – Irving H. Shames (McGraw Hill)
 5.Introduction to Fluid Mechanics – James A. Fay (Prentice Hall India)
Name of Reference Books:
 1.Fluid Machines – Dr.JagdishLal (Metropolitan Book Company Private Ltd.)
 2.Fluid Machines – John P. Douglas (Pearson Publication)

Course Outcomes:At the end of the course students will be able to

CO1	Define Turbulent flow in pipe and velocity equations for smooth and rough boundary of pipe.
CO2	Describe the Boundary layer theory and drag and lift.
CO3	Explain the concept of non-uniform flow in open channel.
CO4	Explain the concept of Compressibility effect in pipe flow
CO5	Describe the concept of Hydraulic Machines.

Course Outcomes and their mapping with Programme Outcomes: Fluid Mechanics-II (CE204TPC08)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE204THS02	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Effective Technical Communication	3	-	-	15	15	30			

Course Objectives:
Effective Technical communication is critical in today's world. Most problems in an organization arise as a result of poor communication. Effective communication ensures a smooth flow of ideas, facts, decisions, and advice. This way, employees eliminate hindrances in achieving the organization's target.

Course Content:

Unit-1 Fundamentals of Communication Technical Communication: features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communications; the flow of Communication: Downward, Upward, Lateral of Horizontal (Peer group): Importance of technical communication; Barriers to Communication.

Unit-2 Constituents of Technical Written Communication Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation-various steps.

Unit-3 Business Communication Principles, Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Negotiation & Business Presentation skills.

Unit-4 Presentation Strategies and Listening Skills. Defining Purpose; Audience & Local; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Listening Skills: Active Listening, Passive Listening. methods for improving Listening Skills.

Unit-5 Value-Based Text Readings Following essays form the suggested text book with emphasis on Mechanics of writing. (i) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior (ii) The Language of Literature and Science by A. Huxley (iii) Man and Nature by J.Bronowski (iv) The Social Function of Literature by Ian Watt (v) Science and Survival by Barry Commoner (vi) The Mother of the Sciences by A.J.Bahm (vii) The Effect of Scientific Temper on Man by Bertrand Russell.

Text Book :
1. Improve Your Writing ed. V.N.Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi..
2. Technical Communication: A Practical Approach: Madhu Rani and Seema Verma- Acme Learning, New Delhi-2011
3. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press,2007, New Delhi.

Reference Books:
1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd,2011, New Delhi.

2. Business Correspondence and Report Writing by Prof. R.C.Sharma& Krishna Mohan, Tata McGraw Hill & Co.Ltd.,2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. &Distributors, 2009,Delhi.
4. Developing Communication Skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi.
5. Manual of Practical Communication by L.U.B.Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. English Grammar and Usage by R.P.Sinha,

CourseOutcomes:
CO1 At the end of the semester, employability skills of the students will develop.
CO2 Students will improve their Vocabulary and their Accent.

Course Outcomes and their mapping with Programme Outcomes: Effective Technical Communication (CE204THS02) [NOT TAUGHT BY CIVIL ENGG. DEPARTMENT]

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE204TMC02	L	T	P	CT-I	CT-II	TOTAL	-	-	-
Subject:	Management (Organizational Behaviour)	3	-	-	-	-	-			

Course Learning Objectives:
The objective of this Course is
- To improve students understanding of human behavior in organization and the ability to lead people to achieve more effectively toward increased organizational performance.
- To understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories.
- To understand group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations.
- To understand the organizational system, including organizational structures, culture, human resources, and change.

Course Content:

UNIT 1: FOCUS AND PURPOSE: Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.
UNIT 2: INDIVIDUAL BEHAVIOUR: Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification.Misbehaviour – Types – Management Intervention.Emotions- Emotional Labour – Emotional Intelligence – Theories.Attitudes – Characteristics – Components – Formation – Measurement- Values.Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management.Motivation – importance – Types – Effects on work behavior.
UNIT 3:GROUP BEHAVIOUR: Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques Team building - Interpersonal relations – Communication – Control.
UNIT 4: LEADERSHIP AND POWER: Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.
UNIT 5: DYNAMICS OF ORGANIZATIONAL BEHAVIOUR: Organizational culture and climate – Factors affecting organizational climate – Importance.Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change.Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life.Organizational development – Characteristics – objectives –. Organizational effectiveness

TEXT BOOKS
1. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
2. Fred Luthans, Organisational Behavior, McGraw Hill, 11th Edition, 2001.

Course Outcomes:
At the end of the course the studentsshall be able
CO1 To Compare and contrast theories of organizational behavior.
CO2 To analyze management issues as related to organizational behavior.
CO3 To evaluate ethical issues as related to organizational behavior & to examine challenges of effective organizational communication.
CO4 To examine the differences and similarities between leadership, power, and management & to assess the impact of culture on organizational behavior

Course Outcomes and their mapping with Programme Outcomes: Management Organizational Behaviour (CE204TMC02)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	3	3	3		2	2
CO2								3	3	3	3	2		1	1
CO3								3	3	3	2	2		1	1
CO4								3		3	1	1		1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
Subject Code: CE204PES06		L	T	P	IA	TOTAL	20	50	01
		0	0	2	30	30			
Subject:	Computer Aided Civil Engineering Drawing								

Course objectives:

1. To introduce the fundamentals of Civil Engineering drawing.
2. To practice the understanding of the principles of planning.
3. To develop capability to understand and learn drafting of building drawings.
4. To impart knowledge on drafting software such as AutoCAD

Course Content:

List of Experiments:(at least 10 sheets / plates are mandatory)

1. Drawing of symbols used in building drawings.
2. Drawing of Wooden and Steel, doors, windows and ventilators (Panelled/Glazed).
3. Drawing of different masonry bonds and masonry walls
4. Drawing of different Foundation
5. Drawing of different stair cases (RC/Steel).
6. Drawing of Industrial buildings with trusses
7. Drawing of Plan, elevation and section of Residential Buildings with tiled/flat roof.
8. Drawing of Preparation of site plan and service plans as per building rules for single and two storied buildings.
9. Drawing of Plan, elevation and section of public building like school, college etc.
10. Drawing of septic tanks and soak pit.

Text Books / References:

1. Shah, M.G., Kale, C. M. and Patki, S.Y. Building Drawing with An Integrated Approach to Built Environment, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. AutoCAD Essentials, Autodesk official Press, John Wiley & Sons, USA.
3. National Building Code of India.
4. Building drawing with an integrated approach to built environment by M. Shah, C. Kale, S. Patki, Tata McGraw Hill Education; 4th edition.
5. Building Planning and Drawing by y M.V. Chitawadagi S.S. Bhavikatti, Dreamtech Press.
6. Civil Engineering Drawing & House Planning: A Text Book by B. P. Verma, khanna publishers.
7. Civil Engineering Drawing by by Rangwala, Charotar Publishing House Pvt. Ltd.
8. Building Planning and Drawing by Dr. N. Kumara Swamy, A. Kameswara Rao, Charotar Publishing House Pvt. Ltd.
9. N Krishna Raju, Structural Design and Drawing, Second Edition, Universities Press (India), Private Limited, Hyderabad.

Course Outcomes:

On the completion of this course, the student will be able to:

CO1   The students will be able to plan areas according to the functional requirements and develop line sketches and working drawings of RCC residential buildings for the given area and requirements.

CO2   The students will be able to prepare the plan, section and elevation of a RCC building from given line sketches

CO3   The sents will be able to plan and propose a stair case as per the requirements, suitability and availability of space.

CO4   The students will be able to plan and draw the elevations and sections of industrial buildings with steel trusses and the joint connections.

CO5   The students will be able to develop site plan of a given building using building bye laws/regulations

CO6 The students will be able to make use of Auto CAD software for preparation of plan, elevation and section of a structure/component/element.

Course Outcomes and their mapping with Programme Outcomes: Computer Aided Civil Engineering Drawing (CE204PES06)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2			1	1						2	1	1
CO2	2	1					1			1			3	2	1
CO3	2	1				1	1			1			2	1	1
CO4	2	1					1			1			1		
CO5	3	3	1		1		1				1		2	1	
CO6	3	2					1			1	1	1	3	1	1

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
Subject Code:	CE204PPC03	L	T	P	IA	TOTAL	20	50	01
		0	0	2	30	30			
Subject:	Material testing lab								

Course Objectives:
- To Remember & understand various Properties of Cement & to learn testing methodology of each properties of cement.
- To learn to perform various experiments related to properties of Aggregates.
- To be able to examine the various properties of prefabricated bricks.
- To learn to perform various Destructive & non –destructive tests on concrete.

Course Content:
List of experiments
Testing of cement:
  1.Normal Consistency, Fineness of Cement, Setting times of Cement
  2.Specific Gravity of Cement
  3.Soundness of Cement
  4.Compressive strength of cement
Testing of aggregate:
  5.Fineness modulus of Fine and Coarse aggregate
  6.Bulk density of aggregate
  7.Specific Gravity and Water Absorption of Aggregate
  8.Bulking of Sand
  Testing of bricks
  9.Compressive strength, Water Absorption &Efflorescence of Bricks
Testing of concrete:
  10. Workability of Concrete
  11. Compressive strength
  12. Modulus of Elasticity
  13. Tensile Strength of Concrete
  14. NDT Test of Concrete

Text Books / References:

  1.Building Materials – S.K. Duggal (New Age Publication)
  2.Building Materials – S. C. Rangwala (Charotar Publication)
  3.Building Construction by S.G. Rangwala, Charter Publishing House, Anand, India

Course Outcomes: At the end of the course students will be able to:
CO1   Understand & demonstrate various tests on cement, Aggregates & Bricks.
CO2   Design Concrete for desired grade & test its various mechanical properties.
CO3   Demonstrate modern Non – Destructive method of concrete in-situ testing.

Course Outcomes and their mapping with Programme Outcomes:Material testing lab (CE204PPC03)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	1	3	1	2	2	1						2		3
CO2	2	2	3	3	2	1						2		2
CO3	1	3	1	3	2	2	2					2	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
Subject Code:	CE204PHS01	L	T	P	IA	TOTAL	20	50	01
Subject:	Effective Technical Communication Lab	0	0	2	30	30			

Course Learning Objectives:
Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (I.P.A.)

Course Content:
List of Experiments:

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics/ Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme- Presentation/ Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practicals on a model Audio-Visual Usage.

Reference Books:
1. Bansal R.K. & Harrison: Phonetics in English, Orient Longman, New Delhi.
2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi.
 3. L.U.B.Pandey& R.P.Singh, A Manual of Practical Communication, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press.

Course Outcomes:On completion of the course, the students would be able to:
CO1   Improve interpersonal communication
CO2   Overcome stage fright and enhance confidence
CO3   Participate in GDs
CO4   Master presentation Skills and Interview Skills
CO5   Learn and practice Listening, Reading, Writing and Speaking Skills

   Course Outcomes and their mapping with Programme Outcomes: Effective Technical Communication Lab (CE204PHS01) **[NOT TAUGHT BY CIVIL ENGG. DEPARTMENT]**

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Scheme & Syllabus
(IIIrd Year)
B.Tech.
(Civil Engineering)
V-SEM. to VI-SEM.

SCHEME OF B.TECH.V SEMESTER CIVIL ENGINEERING (New CBCS)

S.No.	Course No.	Subject Theory	Periods			Evaluation Scheme			Credits
			L	T	P	IA*	ESE	Total	
1	CE05TPC08	Design of Concrete Structures	3	1	0	30	70	100	4
2	CE05TPC09	Structural Analysis - II	3	1	0	30	70	100	4
3	CE05TPC10	Highway Engineering	3	0	0	30	70	100	3
4	CE05TPC11	Soil Mechanics - I	3	0	0	30	70	100	3
5	CE05TPC12	Environmental Engineering - I	3	0	0	30	70	100	3
6	CE05THS07*	Management (Organizational Behaviour)	3	0	0	-	-	-	0
Practicals									
1	CE05PPC04	Highway Engineering Lab	0	0	3	30	20	50	1.5
2	CE05PPC05	Soil Mechanics Lab	0	0	3	30	20	50	1.5
		TOTAL					Total Credits		20

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam; * Mandatory Course

SCHEME OF B.TECH.VI SEMESTER CIVIL ENGINEERING (New CBCS)
W.E.F. 2020-21 (EVEN SEMESTER)

S.No.	Course No.	Subject Theory	Periods			Evaluation Scheme			Credits
			L	T	P	IA*	ESE	Total	
1	CE06TPC13	Water Resources Engineering -I	3	0	0	30	70	100	3
2	CE06TPC14	Environmental Engineering - II	3	0	0	30	70	100	3
3	CE06TPC15	Design of Steel Structures	3	1	0	30	70	100	4
4	CE06TPC16	Soil Mechanics - II	3	0	0	30	70	100	3
5	CE06TPE01	Professional Elective -1X	3	1	0	30	70	100	4
6	CE06TOE01	Open Elective -1X	3	0	0	30	70	100	3
		Internship/Industrial Training*							
Practicals									
1	CE06PPC06	Environmental Engineering Lab	0	0	3	30	20	50	1.5
2	CE06PPC07	Computer Applications in Civil Engg. Lab	0	0	3	30	20	50	1.5
		TOTAL					Total Credits		23

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam; * Students have to undergo internship/industrial training for a period of 04 weeks during the summer vacation and shall submit a report signed by the concerned organization to the Department in the 7th Semester.

SYLLABUS	(SEMESTER-V)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE05TPC08	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	Design of Concrete Structures	3	1	-	15	15	30			

Course Learning Objectives:

The objective of this Course is

- To understand the various philosophies of design of concrete structures, related IS Codes
- To understand the design beam for flexure, shear, bond and torsion
- To know the design of slabs and staircase and their detailing
- To learn the design of columns and isolated footings and their detailing

Course Content:

UNIT–1: Introduction to design of concrete structures-limit state analysis and design of beams for flexure, bond
UNIT-2: Shear and torsion
UNIT-3: One way slabs, staircases, Two-way slabs
UNIT-4: Axially and eccentrically loaded columns. (uniaxial only)
UNIT-5: Footings – different types of isolated footings, synthesis of limit state and working Stress methods.

Text Books:
1. Reinforced Concrete Design by S Unnikrishna Pillai & Devadas Menon
2. Limit State Design of Reinforced Concrete by P.C. Verghese
3. Design of Reinforced Concrete Structures by N Krishna Raju

Course Outcomes

At the end of the course the students shall be able
 CO1: To recognize the design philosophy of concrete structures
CO2: To understand the difference between the structural behaviors of different reinforced concrete structural elements
CO3: To analyze and design the reinforced concrete structural elements subjected to gravity loads.

Course Outcomes and their mapping with Programme Outcomes Design of Concrete Structures (CE05TPC08)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-V)		Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE05TPC09	L	T	P	CT-I	CT-II	TOTAL		70	100	04
Subject:	Structural Analysis - II	3	1	-	15	15	30				

The objective of this Course is

- To understand the principles of energy methods and their applications to indeterminate beams and plane frames
- To know the principles of different slope-deflection and moment distribution methods and their applications to ineterminate beams and plane frames
- To study the principles of matrix methods and their applications to beams and frames
- To know the influence lines for indeterminate structures and two-hinged arches

Course Content:

UNIT-1: Analysis of indeterminate beams by Consistent Deformation methods, Analysis of indeterminate rigid plane frames and truss using energy method.

UNIT-2: Slop Deflection Method: Continuous beams and portals by moment distribution due to load and yielding of supports.

UNIT-3: Moment-distribution method. Continuous beams and port
als by moment distribution due
to load and yielding of supports.

UNIT-4: Introduction to Flexibility matrix and Stiffness Matrix methods: Applications of the methods to simple indeterminate beams.

UNIT-5: Analysis of symmetrical two hinge arches (parabolic and circular). Influence lines for propped

cantilevers, continuous beams using Muller-Breslau's principle.

Text Books:

1. Structural Analysis by Devdas Meenon
2. Indeterminate Structural Analysis by C. K. Wang
3. Fundamental of Structu
4. ral Analysis by Lee.
5. Advanced Structural Analysis by A. K. Jain
6. Structural Analysis (SI units) by R C hibbeler
7. Structural Analysis by L S nagi & R S Jangid

Course Outcomes

At the end of the course the students shall be able

CO1   To identify the suitable method of analysis for the analysis of indeterminate structures.

CO2   To analyse the indeterminate beams and rigid and pin joint plane frames for gravity and wind loads

CO3   To analyse the indeterminate structures and two-hinged arches for moving loads by constructing the influence lines

Course Outcomes and their mapping with Programme Outcomes: Structural Analysis (CE05TPC09)

SNO	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO 1	3	3	2	1	2							1	2	1	
2	CO 2	3	3	2	1	2							3	2	1	
3	CO 3	3	3	2	1	2							3	2	1	

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-V)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject Code:	CE05TPC10	3	-	-	15	15	30			
Subject:	Highway Engineering									

Course Learning Objectives:

The objective of this Course is

- To provide a coherent development to the students for the courses in sector of Engineering like Transportation & Traffic Engineering etc.
- To present the foundations of many basic Engineering tools and concepts related Highway Engineering.
- To give an experience in the implementation of engineering concepts which are applied in field of Transportation Engineering.
- To involve the application of scientific and technological principles of planning, analysis, design and management to highway engineering

Course Content:

UNIT-1: Introduction: Importance of highway transportation, Modes of transportation, characteristics of highway transport. Historical development & planning: Historical development of roads, Road development and planning in India, Necessity of planning, Roads classification, patterns, Planning surveys. Highway alignment and surveys: Engineering Surveys for highway location Maps and Drawing. Highway drainage: Importance, Surface and subsurface drainage.

UNIT- 2: Geometric Design: Cross Section elements, Sight Distance, Design of horizontal and vertical Alignment.

UNIT -3: Traffic Engineering: Traffic characteristics, studies such as volume, density, Speed, 'O' and 'D' and their uses, Traffic control devices and road accidents.

UNIT- 4: Highway Materials: Behavior of highway materials, properties of Subgrade materials and pavement component materials. Tests on subgrade soil, aggregate and bitumen.

UNIT- 5: Pavement Design: Types of pavements, Factors affecting design of flexible and rigid pavements, Design of flexible pavements: Group index, I.R.C. recommended method, California highway department method, U. S. Corp method. Design of Rigid pavement: Westergard's stressanalysis of wheel loads for design of pavement, effect of temperature and warping stress in design

Text Books:
1. Principle and Practices of Highway Engineering – Kadiyali & Lab (Khanna Publishers, Delhi).
2. Highway Engineering – S. K. Khanna & C.E.G. Justo (Khanna Publishers, Delhi).
3. Highway Engineering – Rangawala S.C. (Charotar Publishers).
4. A textbook of Transportation Engineering – S.P. Chandola (S. Chand) Transportation Engineering – A.K. Upadhyay (S.K. Kataria & Sons).
5. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010.
6. Khanna, S.K. & Justo, C.E.G., Highway Engineering, NemChand & Bros, Roorkee (U.A).
7. Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi.
8. Sharma, S.K., Principles, Practice and Design of Highway Engineering, S. Chand & Co., New Delhi.
9. IRC – 37 "Guidelines for Design of flexible Pavements", IRC, New Delhi, 2001.
10. IRC – 67 "Code of Practice for Road Signs", IRC, New Delhi – 2001. 30
11. IRC: 58, 2002: "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways", IRC, N. Delhi, December, 2002.
12. IRC:70, 1977: "Guidelines on Regulation and Control of Mixed Traffic in Urban Areas"
13. IRC:106, 1990: "Guidelines for Capacity of Urban Roads in Plain Areas"
14. IRC-73

15. IRC-12
16. Specifications for Road and Bridge Works – MOST (IRC Publishers) Manual for Survey, Investigation and Preparation of Road Projects – IRC Publication 2001.

Course Outcomes
At the end of the course the students shall be able

CO1 To gain an experience in the implementation of Transportation Engineering on engineering concepts which are applied in field Highway Engineering.

CO2 To get a diverse knowledge of highway engineering practices applied to real life problems.

CO3 To learn to understand the theoretical and practical aspects of highway engineering along with the design and management applications.

Course Outcomes and their mapping with Programme Outcomes: Highway Engineering (CE05TPC10)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

.

SYLLABUS	(SEMESTER-V)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
Subject Code:	CE05TPC11	3	-	-	15	15	30	70	100	03
Subject:	Soil Mechanics - I									

Course Learning Objectives:

The objective of this Course is

- To understand the engineering properties of soil.
- To develop the basic understanding of characteristics of soil like permeability, seepage.
- To learn the effective stress and vertical stress in soil.
- To learn the significance of compaction and consolidation on the stability of soil.
- To learn shear strength of different type of soils.

Course Content:

Unit 1: Introduction to Soil Mechanics and Geotechnical Engineering, Complexity of Soil Nature, Soil Formation and Soil Types.
Index Properties of Soil: Basic Definitions, Phase Relationships, Classification of Soils-The Unified Soil Classification System and Indian Standard Soil Classification System, Soil Structure and Clay Minerals.

Unit 2: Soil Compaction: Definition and Compaction Theory, Laboratory Compaction Tests-Standard Proctor Compaction Test & Modified Compaction Test, Factors Affecting Compaction, Effect of Compaction on Engineering Properties of Soil , Field Compaction and Controls.
Principle of Effective Stress, Capillarity and Permeability:Principle of Effective Stress, Capillarity in Soils, Effective Stress under Different Field Conditions, Seepage Pressure, Quick Sand Condition, Permeability, Darcy's Law, Determination of Permeability, Permeability of Stratified Soils, Absolute Co-efficient of Permeability, Factors Affecting Permeability , Seepage through Soils- Laplace's Equation, Flow Nets.

Unit 3: Vertical Stresses below Applied Loads: Stresses due to Applied Loads, Boussinessq and Westergaard Theories for Vertical Stresses under Concentrated Loads, Uniformly Loaded Circular and Rectangular Areas, Pressure Bulb, Variation of Vertical Stress under Point Load along the Vertical and Horizontal Planes, Newmark's influence chart.
Stability of Soil Slopes: Introduction, Types of Slope Failures, Slip Circle Method, Determination of Centre of Most Critical Slip Circle, Taylor's Stability Charts, Stabilization of Soil Slopes.

Unit 4: Shear Strength: Introduction, Stress at a Point and Mohr's Stress Circle, Normal and Shear Stresses on a Plane, Mohr-Coulomb Failure Criterion, Laboratory Tests for Shear Strength Determination, Shear Strength Parameters, Direct shear test, Triaxial shear test, Unconfined Compression Test and Vane Shear test, Shear Strength Characteristics of Normally Consolidated and Reconsolidated Clays, Factors Affecting Shear Strength.

Unit 5: Compressibility: Introduction to Compressibility, Consolidation, Effects of Soil Type, Stress History and Effective Stress on Compressibility , Factors Affecting Consolidation and Compressibility Parameters, Normally Consolidated and Over Consolidated Soils, Types of Consolidation, Terzaghi's Theory of 1-D Consolidation   and Time Rate of Consolidation.

Text Books:
1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International (P) Limited, Publishers, New Delhi-110002.
2. Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series (PB 2018) by V. N. S. Murthy , CBS Publication, New Delhi.
3. Soil Mechanics and Foundations by Dr. B. C. Punmia, Ashok Kr. Jain & Arun Kr. Jain, Laxmi Publications (P) Ltd, New Delhi-110002.
4. Soil Mechanics by Robert V. Whitman & T. William Lambe, Wiley India Pvt Ltd. New Delhi.
5. Soil Mechanics and Foundation Engineering by Purushotama Raj, Pearson Publications, New Delhi.

6. Soil Mechanics and Foundation Engineering (Geotechnical Engineering) by Dr. P. N. Modi, Standard Book House (Rajsons Publications Pvt Ltd) New Delhi-110002

Course Outcomes
At the end of the course the students shall be able

CO1 To have an understanding of soil capable to behaving in different practical conditions.
CO2 To have an idea of engineering properties of soil suitable for foundation.

Course Outcomes and their mapping with Programme Outcomes: Soil Mechanics – I (CE05TPC11)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-V)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE05TPC12	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Environmental Engineering - I	3	-	-	15	15	30			

Course Learning Objectives:
The objective of this Course is
- To learn about various sources of water supply & population forecasting method
- To learn the principles and design of water treatment and distribution.
- To learn about the aspects of air & noise pollution

Course Content:

UNIT 1: Introduction: Necessity and importance of water supply schemes. Water demand: Classification of water demands, Estimation of quantity of water required by a town, per capita demand, factors affecting per capita demand, design period and population forecasting, variation in water demand. Sources of water supply. Surface sources and underground sources, Intake works, site selection, type of intake works.

UNIT 2: Quality of water: Common impurities, physical, chemical and biological characteristics of water, water quality standards for municipal and domestic supplies. Water Processing: Object of water processing, flow diagrams of typical ground water system and surface water systems. Sedimentation Theory of sedimentation, sedimentation tanks and its types, design parameters related with sedimentation tanks, sedimentation with coagulations, coagulants and coagulant aids, Jar test for determining coagulant dosage.

UNIT 3:Filtration; Theory of filtration, slow sand and rapid sand filters, Construction and operation. Disinfection, Methods of disinfection, Chlorination, Types of chlorination, Break Point chlorination.

UNIT 4: Softening: Methods of Softening, Iron Removal, Fluoridisation. Distribution System: Methods of distribution, layout of distribution system, methods of analysis, pressure in the distribution system, distribution reservoirs, functions and its types, storage capacity of distribution reservoir.

UNIT 5: Air Pollution: Introduction, causes, sources, characteristics, effects of air pollution on plants, humans, animals and materials and atmosphere, air pollution control methods and equipment. Noise Pollution: Definition, sources, effects of noise pollution on humans, animals and non-living things, methods of noise control.

Text Books:

1. Water Supply Engineering – S.K. Garg (Khanna Publication).
2. Water Supply Engineering – B.C. Punmia (Laxmi Publication, New Delhi)
3. Environmental Engineering – Peavy & Rowe (Tata McGraw Hill, New Delhi).
4. Water Supply and Sanitary Engineering – G.S. Birdi (DhanpatRai Publications).
5. Introduction to Environmental Science – Y. Anjaneyulu (B.S. Publications)
6. Environmental Science and Engineering – Henry and Heinke (Pearson Education)

Course Outcomes
At the end of the course the students shall be able

CO1   To get an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
CO2   To get an understanding of water quality criteria and standards, and their relation to public health,
CO3   To be able to design and evaluate water supply project alternatives on basis of chosen selection criteria.

Course Outcomes and their mapping with Programme Outcomes: Environment Engineering-I (CE05TPC12)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-V)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
Subject Code:	CE05THS07*									0
Subject:	Management (Organizational Behaviour)	3	-	-	-	-	-	-	-	0

Course Learning Objectives:
The objective of this Course is
- To improve students understanding of human behavior in organization and the ability to lead people to achieve more effectively toward increased organizational performance.
- To understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories.
- To understand group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations.
- To understand the organizational system, including organizational structures, culture, human resources, and change.

Course Content:

UNIT 1:FOCUS AND PURPOSE: Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

UNIT 2: INDIVIDUAL BEHAVIOUR: Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification.Misbehaviour – Types – Management Intervention.Emotions- Emotional Labour – Emotional Intelligence – Theories.Attitudes – Characteristics – Components – Formation – Measurement- Values.Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management.Motivation – importance – Types – Effects on work behavior.

UNIT 3: GROUP BEHAVIOUR: Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Team building- Interpersonal relations – Communication – Control.

UNIT 4: LEADERSHIP AND POWER: Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

UNIT 5: DYNAMICS OF ORGANIZATIONAL BEHAVIOUR: Organizational culture and climate – Factors affecting organizational climate – Importance.Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change.Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life.Organizational development – Characteristics – objectives –. Organizational effectiveness

TEXT BOOKS
1. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
2. Fred Luthans, Organisational Behavior, McGraw Hill, 11th Edition, 2001.

Course Outcomes:
At the end of the course the students shall be able
CO1 To Compare and contrast theories of organizational behavior.
CO2 To analyze management issues as related to organizational behavior.
CO3 To evaluate ethical issues as related to organizational behavior & to examine challenges of effective organizational communication.
CO4 To examine the differences and similarities between leadership, power, and management & to assess the impact of culture on organizational behavior

Course Outcomes and their mapping with Programme Outcomes: Management (Organizational Behaviour) (CE05THS07*)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	3	3	3	3		2	2
CO2								3	3	3	3	2		1	1
CO3								3	3	3	2	2		1	1
CO4								3		3	1	1		1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-V)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE05PPC04	L	T	P	CT-1	CT-II	TOTAL	20	50	1.5
Subject:	Highway Engineering Lab	0	0	3	-	-	30			

Course Learning Objectives:
The objective of this Course is
- To introduce Bitumen and & its engineering behavior.
- To introduce Aggregate & its engineering behavior.
- To introduce Concept of traffic behavior.

Course Content:

    Minimum 10 experiments to be performed
1. To determine the crushing value of the given aggregate sample.
2. To determine 10% finer value of the given aggregate sample.
3. To determine the abrasion value of the given aggregate sample by los angles apparatus.
4. To determine the impact value of the given aggregate sample.
5. To determine the elongation index of the given aggregate sample.
6. To determine the flakiness index of the given aggregate sample.
7. To determine the water absorption of the given coarse aggregate.
8. To determine the specific gravity of the given coarse aggregate.
9. To determine the penetration value of the given bitumen material.
10. To determine the softening point of the given bitumen material.
11. To determine the ductility of the given bitumen material.
12. To determine the viscosity of the given bitumen material
13. CBR Test

Course Outcomes
At the end of the course the students shall be able
CO1   To identify engineering properties of aggregate.

CO2   To identify the grade & properties of bitumen.

Course Outcomes and their mapping with Programme Outcomes: Highway Engineering Lab (CE05PPC04)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-V)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE05PPC05	L	T	P	CT-1	CT-II	TOTAL	20	50	1.5
Subject:	Soil Mechanics- Lab	0	0	3	-	-	30			

Course Learning Objectives:
The objective of this Course is

- To learn the basic tests analysing engineering properties of soil.
- To learn the practical tests computing bearing capacity of soil.
- To learn the sampling of soil.

Course Content:
Minimum 10 experiments to be performed

1. To determine the water content of soil (%) by Oven dry method.
2. To determine the specific gravity of soil sample by
    a) Pycnometer Bottle Method.
    b) Density Bottle Method.
3. To determine the particle size distribution of a soil by Mechanical Analysis.
4. To determine the grain size distribution by Hydrometer apparatus
5. To determine the liquid limit and Plastic limit of a soil sample and Shrinkage limit of a soil sample.
6. To determine in situ dry density of soil by
    a) Core cutter method.
    b) Sand replacement method.
7. To determine the permeability of soil by
    a) Falling Head Methods.
    b) Constant Head Methods.
8. To determine the shear strength of a coarse grained soil (Direct Shear Test).
9. To determine the compressive shear strength of Clay (Unconfined Compression Test/UCS test).
10. To determine the shear strength of c-φ Soil   (Triaxial Test).
11. To determine the consolidation of soil/Clay sample.

TextBooks:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International (P) Limited, Publishers, New Delhi-110002.
2. Soil Mechanics and Foundations by Dr. B. C. Punmia, Ashok Kr. Jain & Arun Kr. Jain, Laxmi Publications (P) Ltd, New Delhi-110002

Course Outcomes
At the end of the course the students shall be able
CO1   To have an understanding of performing various tests on soil accurately giving them practical exposure.

Course Outcomes and their mapping with Programme Outcomes: Soil Mechanics Lab (CE05PPC05)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1			2	2			2	3	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject Code:	CE06TPC13	3	0	-	15	15	30			
Subject:	Water Resources Engineering -I									

Course Learning Objectives:
The objective of this Course is

- To understand the need of Irrigation, types of irrigation systems and Methods of Irrigation.
- To understand the Canal Irrigation systems and design of stable channels in alluvium.
- To understand Water Logging and its Control.
- To know the River behaviour, control and training.
- To know the Reservoir Planning, Hydrograph and Flood Routing and it principle.

Course Content:

UNIT 1: Introduction: Need for Irrigation, advantages and disadvantages of irrigation, types of irrigation systems – Flow irrigation, Lift irrigation. Methods of Irrigation: Introduction, requirement of irrigation methods, surface and sub-surface irrigation. Water Requirement of crops: Introduction, water requirement of crop, crop season and crops of India, crop period and base period, delta, duty of water, relationship between delta, duty and base period, factors affecting duty.

UNIT 2: Canal Irrigation: Classification of canal, parts of canal irrigation system, canal alignment, typical canal cross section, command areas, losses in irrigation systems. Design of stable channels in alluvium. Introduction, Kennedy's silt theory, Lacey's Theory, Lacey's regime equations, Lacey's shock theory, Design of channels by Kennedy's and Lacey's theories, maintenance of irrigation channels.

UNIT 3: Water Logging and its Control. Causes and ill effects of water logging, prevention and control, reclamation of water logged lands, surface drainage. Design of Lined Channels. Introduction, benefits of lining, types of lining, economics of lining, procedure and design of lined canals.

UNIT 4: River behaviour, control and training. Objects, river characteristics, classification of river training works, methods of river training embankments, bank protection, cut-offs, meandering causes and parameters. Flood Control; Introduction, channel improvement, flood ways evacuation and flood plain zoning.

UNIT 5: Reservoir Planning: Introduction, type of reservoirs, investigation for reservoir planning, site selection criteria for reservoir, basic terms and definitions of reservoir, storage zones of a reservoir, mass curve and demand curve, determination of reservoir capacity, reservoir losses, reservoir sedimentation, factors affecting sedimentation, type of sediment load, life of reservoir, safe field.

TEXT BOOKS:

1. Irrigation Engineering and Hydraulic Structures – S.K. Garg (Khanna Publications)
2. Irrigation Engineering – B.C. Punmia (Laxmi Publications)
3. Irrigation, Water Resources and Water Power Engineering – Dr. P.N. Modi (Standard Book House)
4. Theory and Design of Irrigation Structures (Volume – I & II) – Varshney (Nem Chand & Bros.)
5. Irrigation and Water resources Engineering – Asawa G.L. (New Age International Publications)
6. Fundamentals of Irrigation Engineering – Bharat Singh (Nem Chand & Bros)
7. Water Resources Engineering Larry -W. Mays (Wiley, John & Sons)

Course Outcomes
At the end of the course the studentsshall be able

CO1	To describe about the types of Irrigation systems, and methods of irrigation.
CO2	To design irrigation canals and canal network
CO3	To illustrate about the solution regarding water logging and drainage.
CO4	To illustrate river training work sand Flood Control of river.
CO5	To find out capacity of reservoir and use Flood Routing principle for Reservoir Planning.

Course Outcomes and their mapping with Programme Outcomes: Water Resources Engineering –I (CE06TPC13)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/Week			Internal Assessment(IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject Code:	CE06TPC14	3	--	-	15	15	30			
Subject:	Environmental Engineering - II									

Course Learning Objectives:
The objective of this Course is
- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena in the sewage
- To understand the concept successful design, operation and maintenance of sewage treatment plant

Course Content:

UNIT 1: Objective, design period, Physical, Chemical and Biological characteristics. Waste water sampling, self-purification of natural streams, effluents Standards, Oxygen Sag Curve, sources of sewage. Design of sanitary sewers, minimum size of sewer, velocities in sewers and gradient of sewers. Sewer appurtenances viz. manholes, street inlets, flushing devices, Vent pipes etc.

UNIT 2: Waste Water primary Treatment: characteristics of wastewater. Effluent discharge standards, Primary, secondary and tertiary treatment of wastewater. Types of screens, design of screen chamber, sources of grit, design of grit chamber, disposal of grit, oil and grease removing skimming tanks, design of PST with inlet and outlet details, primary sludge and its disposal

UNIT 3: Aerobic Treatment UNITs: Biological principle of ASP, SVI, sludge bulking and control; biological principle of Trickling filter, re-circulation, operational troubles; Rotating biological contactor. Low cost treatment methods: Principle of Oxidation pond, symbiosis, principle of Aerated Lagoons, aeration method, Principle of Oxidation Ditches, sewage farming, ground water recharge.

UNIT- 4: Anaerobic Treatment UNITs: Septic tanks, biological Principle, method of treatment and disposal of tank effluent. Anaerobic digester, principle of anaerobic digestion, Stages of digestion, bio-gas production. Sludge disposal methods, advantages and disadvantages, Design of STP.

UNIT 5:Municipal Solid Wastes: Characteristics, generation, collection & transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment & disposal), environmental & health implications, disposal of solid waste by land filling, composting and incineration methods. Hazardous waste management, environmental and health implications due to Exposure, incineration, landfill disposal, site remediation, disposal of refuse by Composting.

TEXT BOOKS:

1. Environmental Engineering – Peavy & Rowe (Tata McGraw Hill, New Delhi).
2. Waste Water Engineering – S.K. Garg (Khanna Publication).
3. Manual on sewerage & sewage Treatment published by Ministry of UrbanDev. GOI,Ministry of Urban development
4. Waste Water Engineering – Metcalf Eddy (Tata McGraw Hill, New Delhi).
5. Hazardous Waste management: M.D. LaGrega, P.L. Buckingham, J.C.Evans
6. Manual on Municipal Solid Waste Management: CPHEEO (Ministry of Urban Dev.)
7. Environmental Engineering-II.P.Venugopala Rao Tata McGraw Hill
8. Water and Wastewater Technology ,Hammer (PHI)

Course Outcomes
At the end of the course the students shall be able
CO1 To estimate sewage generation and design sewer system including sewage pumping stations

CO2 To understand the characteristics and composition of sewage, self-purification of streams

CO3 To perform basic design of the unit operations and processes that are used in sewage treatment

Course Outcomes and their mapping with Programme Outcomes: Environmental Engineering – II (CE06TPC14)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject Code:	CE06TPC15									
Subject:	Design of Steel Structures	3	1	-	15	15	30			

Course Learning Objectives:
The objective of this Course is
- To introduce steel structures and its basic components
- To introduce structural steel fasteners like welding and bolting
- To design tension members, compression members, beams and beam-columns.
- To design column splices and bases Course outcomes
- To introduce the design of eccentric connections, plate girders.

Course Content:

UNIT 1: Introduction: General, types of Steel, mechanical behaviour of steel, measures of Yielding, measures of Ductility, types of Structures, Structural Steel Sections. Methods of Structural design: Introduction- Design Philosophies-Working Stress method-Ultimate Strength method-Load and Resistant factor- Limit State Method-Partial safety factor-Load-Load combinations-Classification of Cross sections- General aspects in the design.

UNIT 2: Design of Steel fasteners: Types of fasteners – Riveted connections- Bolted connections- Assumptions- Failure of bolted joints – Strength of bolted joints – Design examples – Design of Welded connections – Butt weld- fillet weld – Design examples.

UNIT 3:Design of Tension Members: General – Modes of Failure of Tension member- Analysis of Tension members- Example - Design steps – Design examples – Lug angles – Design. Design of Compression Members: General – Strength of Compression members- Design Compressive strength- Example on analysis of Compression members – Design of Angle struts – Design Examples- Built up Columns- Design of Lacing – Design of Battens- Design Examples- Design of Roof members.

UNIT 4: Design of Beams: General- Lateral Stability of Beams- Bending Strength of Beams – Plastic Section Modulus - Design Examples. Design of Beam Columns: Behaviour of members under combined loading – Modes of Failures – Design Examples. Design of Column Splices and Column Base: Design of Column Splice-Design Examples- Design of Column Base- Slab Base- Gusseted Base- Design Examples.

UNIT 5: Design of Eccentric Connections: Design of Brackets- Type-1 and Type 2 – Moment Resistant connections - Design Examples. Design of Plate Girder: General- Components of Plate Girder- Optimum depth – Bending Strength – Shear Strength – Shear Buckling- Simple Post critical method- Tension Field method- Stiffeners-Bearing- Transverse stiffeners - Design Examples.

Text Books:
Limit state Design of Steel Structures – S K Duggal.
2. Design of Steel structures: By Limit State Method– S. S. Bhavikatti.
3. Design of Steel Structures- K. S. Sai Ram
4. Design of Steel Structures-Limit States Method-N. Subramanian
5. Comprehensive Design of Steel Structures – Dr B.C.Punmia, Ashok Kr.Jain, Arun Kr. Jain
6. Design of Steel Structures- S. Ramamrutham
7. Steel Structures (Design & Drawing) – A. K. Upadhayay
8. Fundamentals of Structural Steel Design – M. L. Gambhir

9. Limit state Design of Steel Structures – S Kanthimathinathan
10. Design of Steel Structure Volume-I- Ramchandra
11. Design of Steel Structure Volume-II- Ramchandra
12. Design and Analysis of Connections in Steel Structures-Fundamentals and examples- Alfredo Boracchini
13. IS-800:2007- Indian Standard- General Construction in Steel-Code of Pr., & Steel Tables

Course Outcomes
At the end of the course the students shall be able

CO1   To understand design philosophies and behaviour of structural steel
CO2   To analyze and design of tension members
CO3   To analyze and design of columns
CO4   To analyze and design of beams
CO5   To analyze and design of beam-columns
CO6   To analyze and design of simple bolted and welded connections
CO7   To design plate girders

Course Outcomes and their mapping with Programme Outcomes-Design of Steel structures (CE06TPC15)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2								2	1	2
CO2	3	3	3	2	2	1							3	2	2
CO3	3	3	3	2	2	1							3	2	2
CO4	3	3	3	2	2	1							3	2	2
CO5	3	3	3	2	2	1							3	2	2
CO6	3	2	3	3	2	1							3	2	2
CO7	3	3	3	2	2	1							3	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TPC16	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Soil Mechanics - II	3	-	-	15	15	30			

Course Learning Objectives:
The objective of this Course is
- To understand the effect of backfill on retaining wall.
- To learn the bearing capacity of soil and methods to calculate it.
- To learn the analysis of stability of shallow and deep foundation for superstructure loading.
- To learn about exploration and sampling of soil.

Course Content:

Unit 1: Soil Exploration: Introduction, Different Phases of Soil Explorations, Methods of Subsurface Exploration- Trail Pits, Boring Methods, Sounding Test and Geophysical Explorations, Samples and Samplers, Soil Exploration Reports and Bore Log.

Unit 2: Earth Pressures: Introduction, Effect of Wall Movement on Earth Pressure, Earth Pressure at Rest, Rankine's Earth Pressure Theory and its Limitations, Coulomb's Theory of Earth Pressure, Culmann's Graphical Method, Additional Earth Pressure due to Surcharge.

Unit 3: Shallow foundations: Types of shallow foundations and choice, basic requirements, significance of these foundations
Bearing capacity of foundation: Introduction, Bearing Capacity and its Different Forms, Modes of Shear Failure, Evaluation of Bearing Capacity- Prandtl's Method, Terzaghi's Bearing Capacity, Skempton's Method, Meyhof's Method , Hansen's and Vesic's Assumptions and IS Code Recommendations, Estimation of Bearing Capacity Based on Field Methods-Standard Penetration Test, Static Penetrations Test and Plate Load Test, Settlement of Shallow Foundations.

Unit 4: Pile Foundations: Introduction, Classifications of Piles, Cast in Situ Pile Construction, Selection of Pile Type, and Pile Load Capacity in Compression- Static Pile Load Formulae, Pile Load Test, Dynamic Pile Formulae, Group Action of Piles, Negative Skin Friction, Group Efficiency of Piles and Settlements.

Unit 5: Well Foundation: Introduction, Types of Well or Caissons, Components of Well Foundation, Shapes of Wells, Depth of Well Foundation, Forces Acting on Well Foundation, Construction and Sinking of a Well.

Text Books:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International (P) Limited, Publishers, New Delhi-110002.
2. Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series (PB 2018) by V. N. S. Murthy , CBS Publication, New Delhi.
3. Soil Mechanics and Foundations by Dr. B. C. Punmia, Ashok Kr. Jain & Arun Kr. Jain, Laxmi Publications (P) Ltd, New Delhi-110002.
4. Foundation Engineering by B. C. Chattopadhay & Joyanata Maity,PHI Learning Private Limited, Delhi-110092.
5. Soil Mechanics by Robert V. Whitman & T. William Lambe, Wiley India Pvt Ltd. New Delhi.
6. Soil Mechanics And Foundation Engineering by P.Purushotama Raj, Pearson Publications, New Delhi.
7. Geotechnical Engineering by B. M. Das, Bharat Singh, SamsherAlam.

8. Soil Mechanics and Foundation Engineering (Geotechnical Engineering) by Dr. P. N. Modi, Standard Book House (Rajsons Publications Pvt Ltd) New Delhi-110002 .

Course Outcomes

At the end of the course the studentsshall be able

CO1   To have an understanding of suitable foundation for different practical conditions.
CO2   To have an idea about sampling of soil for various tests.

Course Outcomes and their mapping with Programme Outcomes Soil Mechanics - II (CE06TPC16)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

List of Professional (Core) Electives

SYLLABUS	(SEMESTER-VI)						
Subject Code:	CE06TPE01X	CREDITS: 4			SESSIONAL - TA		ESE
Subject:	Professional Elective -1X	L	T	P	CT-I	CT-II	TOTAL	
		3	1	-	15	15	30	70
	Professional Elective-1A or Professional Elective-1B or Professional Elective-1C or Professional Elective-1D or Professional Elective-1E	Any one subject to be Selected from the Professional Electives (Group-1 i.e. CE06TPE01A or CE06TPE01B or CE06TPE01C or CE06TPE01D or CE06TPE01E)						
	Professional Electives Group -1							
	CE06TPE01A	Structural Analysis by Matrix Methods						
	CE06TPE01B	Advanced Surveying						
	CE06TPE01C	Advanced Concrete Design						
	CE06TPE01D	Railway Engineering						
	CE06TPE01E	Basics of Computational Hydraulics						

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject Code:	CE06TPE01A	3	1	-	15	15	30			
Subject:	Structural Analysis by Matrix Methods(Professional Elective -1X)									

Course Learning Objectives:
The objective of this course is
- To understand the flexibility and stiffness matrices and their relationship between them
- To understand the analysis of continuous beams by force (flexibility) and displacement (stiffness) methods
- To understand the analysis of rigid and pin jointed plane frames by force and displacement methods
- To differentiate the force and displacement methods
.
Course Content:
UNIT-1: Static indeterminacy, kinematic indeterminacy; Matrix concepts and Matrix analysis of structures: Flexibility and Stiffness; Flexibility Matrix; Stiffness matrix; Relationship between Flexibility matrix and Stiffness matrix; Force displacement methods; Indeterminate Beams: Introduction; Analysis of indeterminate beams by flexibility and stiffness methods; Comparison of flexibility and stiffness methods

UNIT-2: Rigid Joint Plane Frames: Introduction; Static indeterminacy; Analysis of rigid joint plane frames by flexibility method.

Unit-3: Rigid Joint Plane Frames: Introduction; Kinematic indeterminacy; Analysis of rigid joint plane frames by Stiffness matrix method.

UNIT-4: Pin-jointed Plane Frames (Trusses): Introduction; Static indeterminacy of pin jointed truss; Analysis of pin joint plane frames (trusses) by flexibility method.

Unit-5: Introduction; Kinematic indeterminacy of a Pin-jointed plane frame; Analysis of pin joint plane frames (trusses) by stiffness method.

Text Books:

1. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2009
2. Asslam Kassimali, "Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA, 1999.
3. Weaver W. and Gere J. M., "Matrix Analysis of Framed Structure", CBS Publishers, Delhi.
4. Amin Ghali, Adam M Neville and Tom G Brown, "Structural Analysis: A Unified Classical and Matrix Approach", Sixth Edition, 2007, Chapman & Hall.
5. Devdas Menon, "Structural Analysis", Narosa Publishing House, 2008.
6. McGuire, W., Gallaghar R. H. &Zimian, R. D. "Matrix structure analysis", John Willey Publication
7. G S Pandit & S P gupta, "Structural Analysis-A Matrix Approach"

Course Outcomes
At the end of the course the students shall be able
   CO1   To develop stiffness and flexibility matrix for prismatic members
   CO2 To do matrix computations to analyse structures

Course Outcomes and their mapping with Programme Outcomes: Structural Analysis by Matrix Methods (CE06TPE01A)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TPE01B	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	Advanced Surveying (Professional Elective -1X)	3	1	-	15	15	30			

Course Learning Objectives:
The objective of this Course is
- To understand about concepts of Astronomical Surveying.
- To know the applications of cadastral surveying in different projects.
- To be capable to compute the accuracy of observations made.
- To learn the theory of triangulations surveying.
- To learn about various advanced equipment of surveying

Course Content:
UNIT 1: Triangulation and Baseline Measurements: Triangulation figures or systems, station marks, signals, towers, baseline measurement by rigid bars, flexible apparatus, problems, satellite station and reduction to centre.

UNIT 2: Theory of Errors: Types and sources of errors, theory of least squares, method of weights, method of correlates, angle and station adjustment, figure adjustment. Land Surveys: Layouts, measurements.

UNIT 3: Aerial photogrammetry : Introduction, Principle, Uses, Aerial camera, Aerial 6 10 photographs, Definitions, Scale of vertical and tilted photograph,, Ground Co-ordinates, Displacements and errors, Ground control, Procedure of aerial survey, Photomaps and mosaics, Stereoscopes, Parallax bar.

UNIT 4: Field Astronomy: Introduction, purposes, astronomical terms, determination of azimuth, latitude , longitude and time corrections to the observations.

UNIT 5: Remote Sensing Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation, Digital image processing, Global Positioning system.
Geographical Information System Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering.

Text Books:

1. Borden D. Dent, Jeffrey Troguson, Thomas W. Hodler, Cartography: Thematic Map Design, McGraw-Hill Higher Education, 2008.
2. Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India, 2007.
3. Hoffman.B, H.Lichtenegga and J.Collins, Global Positioning System - Theory and Practice, Springer - Verlag Publishers, 2001.
4. Punmia B. C, Ashok K. Jain, Arun K. Jain, Higher Surveying, Laxmi Publications, 2005.
5. Surveying Vol. I, II and III by Dr. B.C. Punamia, Laxmi Publishers. New Delhi
6. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni, Pune Vidhyarthi Gruh
7. Surveying Vol. I, II and III by Dr. K.R. Arora, Standard Book House. New Delhi
8. Surveying Vol. I and II by S. K. Duggal, Tata Mcgraw Hill, New Delhi
9. Surveying and Levelling by N.N. Basak, Tata Mcgraw Hill, New Delhi
10. Surveying and Levelling by R. Agor, Khanna Publishers, New Delhi
11. Advanced Surveying by R. Agor, Khanna Publishers, New Delhi
12. Fundamentals of Surveying by Roy, S.K., Prentice Hall India, New Delhi
13. Surveying and Leveling by Subramanian, R., Oxford University Press, New Delhi

14. Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.
15. Remote sensing and Image interpretation by T.M Lillesand,. R.W Kiefer,. and J.W Chipman, 5th edition, John Wiley and Sons India
16. Surveying theory and practice 7th Edition by James M Anderson and Adward M Mikhail Tata McGraw Hill Publication.

Course Outcomes

At the end of the course the students shall be able

CO1   To be able to understand the aspects of astronomical surveying.
CO2   To be able to define boundaries of construction area of projects.
CO3   To be able to adapt the surveying equipment on the field.

Course Outcomes and their mapping with Programme Outcomes Advanced Surveying (Professional   Elective -1X) (CE06TPE01B)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TPE01C	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	Advanced Concrete Design (Professional Elective -1X)	3	1	-	15	15	30			

Course Learning Objectives:
The objective of this Course is
- To understand the design procedures for combined footings.
- To study the design of retaining walls
- To know the design of different types of water tanks
- To learn the design of flat slabs
- To know the design of RCC chimneys

Course Content:
UNIT 1: Combined Footings: Simple Rectangular, trapezoidal footings (with and without central beam); Strap footing; raft foundation.
UNIT 2: Types of retaining walls; Cantilever Retaining wall design; Counterfort retaining wall (demonstration only)
UNIT 3: Water tanks resting on ground; Intze type water tank design
UNIT 4: Large span concrete roofs, Introduction– classification- behaviour of flat slabs - direct design and equivalent frame method- Codal provisions - waffle slabs.
UNIT-5: Chimneys, analysis of stresses in concrete chimneys- uncracked and cracked sections- Codal provisions- design of chimney.

Text Books:
1. Purushothaman, P., Reinforced Concrete Structural Elements-, Tata McGraw Hill, 1986
2. Ashok K Jain, Reinforced Concrete –Nem Chand Bros. Roorkee , 1998
3. Jain and Jaikrishna, Plain and Reinforced Concrete – Vol I and II Nem Chand Bros., Roorkee, 2000.
4. Taylor C Pere, Reinforced Concrete Chimneys, Concrete publications, 1960
5. Design of deep girders, Concrete Association of India, 1960
6. Advanced Reinforced Concrete Design by N Krishna Raju
7. Mallick and Gupta, Reinforced Concrete, - Oxford and IBH, 1982
8. BIS codes (IS 456 , IS 2210, IS 4998, IS 3370, SP 16, SP 24, SP 34).
9. IRC Codes (IRC 5, IRC 6, IRC 21)
10. Reinforced Concrete Design by Devdas Menon and S U Pillai,

Course Outcomes
At the end of the course the students shall be able
CO1   To design different types of combined footings
CO2   To design cantilever retaining wall
CO3   To design Water tanks resting on ground and Intze tank with staging and foundation
CO4   To design flat slabs
CO5   To design RCC chimneys

Course Outcomes and their mapping with Programme Outcomes Advance Concrete Design (CE06TPE01C)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TPE01D	L	T	P	CT-1	CT-II	TOTAL			
Subject:	Railway Engineering(Professional Elective -1X)	3	1	0	15	15	30	70	100	04

Course Learning Objectives:

The objective of this Course is

- Comprehend different parts of the rail track, their functions and its operation system with respect to construction and engineering applications.
- Comprehensive understanding of the main factors involved in constructing, maintaining and operating railway networks.
- Explain essential features and requirements of different types of crossings and signal system, maintenance of tracks and required procedures.
- Provides scope and opportunities to the students of civil engineering for acquiring appropriate knowledge, skills and abilities in order to perform their job effectively related to construction and management of railway

Course Content:

UNIT 1: Introduction to Railways in India: Role of Indian Railways in National Development Railways for Urban Transportation –LRT & MRTS. Alignment of Railway Lines: Engineering Surveys for Track Alignment. Permanent Way: Components and their Functions

UNIT 2: Rails - Types of Rails, Length of rail, Weight of Rail, Rail Joints, Creep of rail, Buckling of r   ail, Kinks of Rail Fastenings, Coning of Wheels& tilting of rails.
Sleepers –Types, Functions, sleeper density
Ballasts- Types, function, advantage & disadvantage of each type.

UNIT 3: Geometric Design of Railway Tracks: Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal Curves.

UNIT 4:Points and Crossings, Turnouts: Working Principles, Cross overs.

UNIT 5: Signalling: Types and their function. Station and Yards: Types, Requirements, factors for site selection.

Text Books:

1. Chandra S. and M.M. Agarwal, Railway Engineering, Oxford University Press, New Delhi, India, 2007.
2. Saxena, S.C. and S.P. Arora, Railway Engineering, Dhanpat Rai and Sons, New Delhi, India, 1997.
3. Agarwal, M.M., Indian Railway Track, Prabha and Co., New Delhi, India, 1988.
4. Rangwala, S.C., Principles of Railway Engineering, Charotar Publishing House, Anand, India, 1988.
5. J. S. Mundrey, "Railway Track Engineering", McGraw Hill Publishing Co., 2009

Course Outcomes

At the end of the course the students shall be able to:

CO1   The Students are expected to handle the design, construction, and operation of railroads and mass transit systems that use a fixed guide way.

CO2   The Students are expected to handle the tasks that include determining horizontal and vertical alignment design, station location and design, and construction cost estimating.

CO3   Explain various aspects related to construction and maintenance of Railway.

CO4   Describe various procedures for construction activities related to Railway.

CO5   Supervise Railway

Course Outcomes and their mapping with Programme Outcomes :Railway Engineering (CE06TPE01D)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
CO 1							64		1			3	2		
CO 2	2	1							1			3	2		
CO 3	2	1	2						1			3	2		
CO 4	2	1				2			1			3	2		
CO 5	2					2			1			3	2		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TPE01E	L	T	P	CT-1	CT-II	TOTAL			
Subject:	Basics of Computational Hydraulics (Professional Elective -1X)	3	1	0	15	15	30	70	100	04

Course Learning Objectives:

The objective of this Course is to
- Provide knowledge on application of computational fluid mechanics to different Civil of engineering problems.
- Provide knowledge on conservation law and the numerical approach to solve by converting different form of partial differential equations.
- Provide some experience in the software engineering skills associated with the implementation of MATLAB computer programming and use of Computational Fluid Dynamics (CFD) software.

Course Content:
Unit 1: Introduction, significance of computational hydraulics, discrete forms of the laws of conservation of mass, momentum and energy, examples of free surface flows.

Unit 2: Continuous forms of the conservation laws, lateral inflow's 1-D expansions and contractions, homogeneous and stratified fluid flows.

Unit 3: Introduction to computer programming and computation with MATLAB and using of Computational Fluid Dynamics (CFD) software.

Unit 4: Pipe flow analysis, Open channel flow: Types of Open Channel Flow, Estimation of normal and critical depth, uniform flow computations

Unit 5: Computation of water surface profile (WSP) gradually varied flow estimation using direct step methods.

Text Books:
1. Sreenivas Jayanti, Computational Fluid Dynamics for Engineers and Scientists, Springer, 2018.
2. J.D. Hoffman, Numerical Methods for Engineers and Scientists, CRC Press, Special Indian Edition, 2011.
3. K. A Hoffmann, Computational Fluid Dynamics, Engineering Education System, 2000.
4. M.H. Choudhary, Applied Hydraulic Transients, Van Nostrand Reinhold, New York, 1997.
5. M.B. Abbot & A.W. Minns, Computational Hydraulics, Ashgate Publication, 1994.
6. J.D. Anderson, Computational Fluid Dynamics, McGraw Hill, 1995.
7. C.B. Vreugdenhill, Computational Hydraulics: An Introduction, Springer-Verlag, Berlin, 1989.
8. M.B. Abbott & J.A. Gunge, Engineering Applications of Computational Hydraulics –Pitman Books Ltd., 1982.

Course Outcomes
At the end of the course the students shall be able

CO1   To understand the governing equations based on conservation principals in fluid flow problems,
CO2   To know the use of finite difference method applied to fluid flow problems,
CO3   To check the output from numerical method as compared to the observed data
CO4   To develop computer skill.

Course Outcomes and their mapping with Programme Outcomes: Basics of Computational Hydraulics (Professional Elective -1X) (CE06TPE01E)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

List of Open Electives-1(OE Group-1)

SYLLABUS	(SEMESTER-VI)						
Subject Code:	CE06TOE01X	CREDITS:3			SESSIONAL - TA		ESE
Subject:	Open Elective -1X	L	T	P	CT-I	CT-II	TOTAL	
		3	-	-	15	15	30	70
Open Elective-1A or Open Elective-1B or Open Elective-1C or Open Elective-1D	Any one subject to be Selected from the Open Electives Group (i.e. CE06TOE01A or CE06TOE01B or CE06TOE01C or CE06TOE01D)							
Open Electives Group 1								
CE06TOE01A	Metro Systems and Engineering							
CE06TOE01B	Rural Technology and Community Development							
CE06TOE01C	Remote Sensing and GIS							
CE06TOE01D	ICT for Development							

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TOE01A	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	Metro Systems and Engineering (Open Elective -1X)	3	0	0	15	15	30			

Course Learning Objectives:
- To introduce concepts of different types of mode of transportation and associated facilities.
- To familiarize the students with the concepts of 1-D and 2-D signals, design of 1-D and 2-D filters and various aspects of image processing.
- To study town planning concepts and theories.
- To perceive the concept of urbanization and various growth patterns.
- To study the concepts for different area planning for urban PTS.
- To understand the concept of urban transport scenario, traffic characteristics and transport development.
- To get the knowledge of advanced transportation engineering planning and management techniques.
- To understand the approach and utility of Environmental Impact Assessment for the urban infrastructural measures.

Course Content:

Unit 1: Modes of Transportation:Transportation parameters- Traffic and Transport Problems of a city, Mass transport system, Modes of transportation & characteristics, Public transport system, public private transport system, Advantages and disadvantages of Public transport system. Role of transportation in mass transportation, advanced modes.
Transportation Infrastructure- Green bays, control stations, mitigation buildings, separator lanes and safety islands.

Unit 2: Urban Public Transport System Rapid transit systems: BRTS, Bus Lane system, Advantages and limitations in Indian Scenario, Rail System, Types of rail system, advantages and disadvantages of rail system, sky walk and under bridge and its advantages. Advances in infrastructure.
Urban Pedestrian Safety- Skyways, Intersection subways, halt stations, crossing measures, flexibility in accessibility.

Unit 3: ITS Background and Telemetric systems:Definitions, features and objectives of ITS, History of ITS and its development over the world, telemetric concept, transport telemetric, telemetric structure, ITS taxonomy, ITS application areas, uses, and application overview, ITS implication through AI, ITS based regression models.

Unit 4: ITS components, tools and strategies:Components of user services; advanced traffic management system, advanced traveler information systems, advanced vehicle controlsystem, commercial vehicle operational management, advanced public transportation system, electronic payment system, advanced rural transportation, security and safety systems, urban traffic control, benefits and limitations, traffic calming systems, freight management by ITS.

Unit 5: Environmental ImpactAssessment: Description of proposed activity, structural audits, analysis of site selection procedure, baseline conditions / major concerns, green building and its advantages, description of potential positive and negative environmental, social, economic and cultural impacts including cumulative, regional, temporal and spatial considerations, significance of mitigation plans and monitoring plans (impacts and mitigation efforts)

Text Books:

1. Kadialy L.R., "Traffic Engg. and Transport Planning", 8th edition, Khanna Publishers, 2011.
2. O. Flaherty C.A., "Traffic Engineering and Transport Planning", 2006.
3. AUSTROADS, The Implication of Intelligent Transport Systems for Road Safety, Austroads Incorporated, 1999. 2. Bob Williams, Intelligent Transport Systems Standards, Artech House Publishers, 2008.
4. Chowdhury, M. A. and Sadek, A, Fundamentals of Intelligent Transportation Systems Planning, Artech House, 2003.
5. E. Bekiaris and Y.J. Nakanishi, Economic Impacts of Intelligent Transportation Systems: Innovations and Case Studies, Elsevier/JAI, 2004. 5. IET Intelligent Transport Systems and 15th International IEEE Conference on Intelligent Transportation Systems (ITSC), 16-19 September, 2012. (http://digital-library.theiet.org/content/journals/iet-its)
6. J.M. Sussman, Perspectives on Intelligent Transportation Systems (ITS), Springer, 2005
7. L. Vlacic, M. Parent, F. Harashima, Intelligent Vehicle Technologies – Theory and Applications, Butterworth-Heinemann, 2010.
8. M.A. Chowdhury and A. Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, 2010.
9. R. Stough, Intelligent Transport Systems: Cases and Policies, Edward Elgar, 2001, Artificial Intelligence and Intelligent Transportation Systems, National Academy Press, 2010.
10. Gonzalez R. C. and Woods R. C., "Digital Image Processing", 2nd Ed., Pearson Education, 2007.
11. Jain A. K, "Fundamentals of Digital Image Processing", Prentice Hall, 2007.
12. R.R. Barthwal "Environmental Impact Assessment" New Age International, January 2012.
13. A.R. Gajbhiye & S.R. Khandeshwar N.S. Raman, "Environmental Impact Assessment", I.K. International, 2014

Course Outcomes: At the end of the course, students will be able to

CO1   Concepts of different types of mode of transportation and associated facilities with advanced system.
CO2   Identify and differentiate ITS user services and its components.
CO3   Select and provide appropriate ITS technology to solve real-life traffic problems.
CO4   Manage the traffic congestion by acquisition of big data using advanced devices.
CO5   Implement the suitable ITS and services for effective transportation.
CO6   Propose the mitigation plan for the EIA for the urban infrastructure.

Course Outcomes and their mapping with Programme Outcomes: Metro Systems and Engineering (Open Elective -1X) (CE06TOE01A)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1							3	2	1
CO2	2	2	3	3	3	1							3	3	2
CO3	3	2	2	2	3	2							3	2	2
CO4	2	2	3	3	3	2							3	3	1
CO5	2	2	1	2	3								2	2	2
CO6	2	2	3	3	2	3	3						3	1	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TOE01B	L	T	P	CT-1	CT-II	TOTAL			
Subject:	Rural Technology and Community Development (Open Elective -1X)	3	0	0	15	15	30	70	100	03

Course Learning Objectives:
The objective of this Course is
- To understand theories and practices in the rural development model.
- To learn and analyse rural life and rural economy.
- To understand different measures in rural development.
- To learn different technologies used in upliftment of rural life.

Course Content:

UNIT 1: INTRODUCTION: RURAL DEVELOPMENT - Concepts and connotations, Basic Elements, Growth vs. Development, Why rural development, Rising expectations and development, Development and Change, Human beings as cause and consequences of development. RURAL ECONOMY OF INDIA - Introduction, size and structure, The characteristics of rural sector, The role of agricultural sub-sector, The role of non-agricultural sub-sector, Challenges and opportunities

UNIT 2: RURAL DEVELOPMENT - MEASURES AND PARADIGMS: MEASURES OF DEVELOPMENT - Introduction, Measures of level of rural development, Measures of income distribution, Measures of development simplified, Concepts and measures of rural poverty. PARADIGMS OF RURAL DEVELOPMENT - Introduction, The modernization theory, The dependency theory of Marxist School, Rosenstein- Rodan's theory of 'Big Push', Lewis' model of economic development, The human capital model of development, The Gandhian Concept of Rural Development theories from other social sciences.

UNIT 3: TECHNOLOGIES FOR RURAL DEVELOPMENT Using Water Resources - The water cycle, Drinking Water, Water quality testing, Water filtering ,Extraction from Groundwater ,Pumps Rope and washer pump ,Manuel pumps, Treadle pump, Irrigation for agriculture, Channel systems, Sprinkler systems, Drip systems Water diversion ,Water storage Building Infrastructures and Creating Energy - Basic energy uses , Energy Sources - Firewood, Solar Energy, Hydro-electricity, Hydro-mechanical, Wind Energy, Energy Storage, Connecting to the Electrical Network, Environmental Use of ICT in Rural and agricultural development - Education, Healthcare, Agriculture, Business, Resource Mapping, Digital and Social Media Marketing Decision Support Systems for soil conservation and farm management Waste Management and Sanitation.

UNIT 4: COMMUNITY DEVELOPMENT: Introduction, Service Learning and community development, Theory and practice of community development, Community development issues. The diverse meaning of community development, the knowledge base of community development, International community development.

UNIT 5: COMMUNITY DEVELOPMENT - RURAL ENTREPRENEURSHIP: Different forms of Rural Entrepreneurship, Significance , Business planning for a new venture: the concept of planning paradigm, Forms of business enterprises-Sole proprietorship, partnership and corporations, Product and Process development, Marketing analysis and competitive analysis, strategies; Financial resources; debt financing, banks and financial institutions and other non-bank financial sources; Government programmes : direct loan assistance and subsidies; Industrial and legal issues for rural enterprises.

Text Books:
1. Rural Development: Principles, Policies and Management" - Katar Singh , Sage Publications.
2. Introduction to Community Development - Theory, Practice and Service Learning", Edited by J W Robinson, Sage Publications.
3. G. N. Tiwari, Solar Energy: Fundamentals, Design, Modelling and Applications, Narosa, 2002.
4. "Fundamentals of Entrepreneurship", H. Nandan, Third Edition, PHL Learning Pvt. Ltd.,
5. Monetary Economics-Institutions, Theory and Policy", First Edition, S B Gupta, S Chand Publications, ISBN – 9788121904346.

Course Outcomes:
At the end of the course the students shall be able to
CO1   Understand rural development model.
CO2   Learn different measures in rural development and its impact on overall economy.
CO3   Understand and learn importance of technologies in rural and community development.
CO4   Understand challenges and opportunities in rural development.

Course Outcomes and their mapping with Programme Outcomes: Rural Technology and Community Development (Open Elective - 1X) (CE06TOE01B)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										3	2	1
CO2	3	2	2								3		3	2	2
CO3	2	2	1										3	1	2
CO4	2	2	2										2	1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE06TOE01C	L	T	P	CT-1	CT-II	TOTAL			
Subject:	Remote Sensing and GIS (Open Elective -1X)	3	0	0	15	15	30	70	100	03

Course Learning Objectives:
The objective of this Course is

- To understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
- To illustrate Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and topo sheet maps.
- To understand different components of GIS and Learning about map projection and coordinate system.
- To develop knowledge on conversion of data from analogue to digital and working with GIS software.

Course Content:

UNIT 1: INTRODUCTION AND CONCEPTS : Introduction of Remote Sensing – Energy sources and Radiation principles, Energy equation, EMR and Spectrum, EMR interaction with atmosphere scattering, absorption, EMR interaction with earth surface features reflection, absorption, emission and transmission, Spectral response pattern , vegetation, soil, water bodies- Spectral reflectance.

UNIT 2: AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY: Introduction-Terrestrial and Aerial photographs - vertical and oblique photographs - height determination contouring - photographic interpretations - stereoscopy – parallax bar- Flight Planning- Photo Interpretation, Applications of aerial photos-photo theodolite.

UNIT 3: SATELLITE REMOTE SENSING PRINCIPLES: Data acquisition –Procedure, Reflectance and Digital numbers- Intensity Reference data, Ground truth, Analog to digital conversion, Detector mechanism-spectro- radiometer-ideal remote sensing system – characters of real and successful remote sensing system- platforms and sensors- orbits types – resolution

UNIT 4: REMOTE SENSING SATELLITES:Land observation satellites, characters and applications, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series, NOAA, GOES, NIMBUS Applications, Marine observation satellites OCEANSAT.

UNIT 5:BASICS OF GIS: Introduction, concepts , information system , components of GIS, History, Geospatial data architecture, Operations, geographic co-ordinate systems, map projections, concepts, input data for GIS , display ,types of output products. GIS categories, Level and scale of Measurement, importance of data quality.

Text Books:

1. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad. 2011. ISBN: 81- 7800-112-8.
2. A.M.Chandra and S.K. Gosh. Remote Sensing and GIS, Narosa Publishing Home, New Delhi 2009.
3. Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman Remote sensing and image interpretation John Wiley & Sons, 2008.
4. George Joseph, Fundamentals of Remote Sensing Universities Press, Hyderabad

Course Outcomes

At the end of the course the students shall be able

CO1   To understand the concepts of Photogrammetry and compute the heights of objects;

CO2   To understand the principles of aerial and satellite remote sensing, able to comprehend the energy interactions with earth surface features, spectral properties of water bodies;

CO3   To understand the basic concept of GIS and its applications, know different types of data representation in GIS;

CO4   To understand and Develop models for GIS spatial Analysis and will be able to know what are the questions that GIS can answer and

CO5   To apply knowledge of GIS software and able to work with GIS software in various application fields.

Course Outcomes and their mapping with Programme Outcomes: Remote Sensing and GIS (Open Electives-1X) (CE06TOE01C)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE06TOE01D							70	100	03
Subject:	ICT for Development (Open Elective -1X)	3	0	0	15	15	30			

Course Learning Objectives:
The objective of this Course is to provide a
- Multi-disciplinary platform along with an emphasis on modern day real time applications.
- Due to the day to day changes in the field of science and technology, ICT program of Engineering will facilitate and provide an opportunity to equip with the skills and knowledge required to design, implement & manage a variety of Information system.

Course Content:

Unit-1: ICT Fundamentals; Information Technology philosophy, Need of information technology, Logic of Information, Cybernetics, Definitions(Peirce, Shannon-Weaver, Bateson), Information and society, Information Processing cycle, Impact of information on the society, IT act of India (Just Introduction), ICT models (brief), Analog Communication, Digital Communication, Data Communication, Structure of Communication, Transmission modes (Simplex, half duplex, Full duplex), Synchronous and Asynchronous transmission, Serial and Parallel communication, Need of Modulation, Antenna Height/length, Energy, Band-Edge Ratio, Multiplexing, Amplitude modulation, Definition, Mathematical derivation and calculation of modulation index, power, Frequency spectrum, Frequency modulation, Definition, Mathematical Derivation and calculation of frequency deviation Frequency spectrum.

Unit-2: Data Networks; Models of Network Computing (Centralize Computing, distributed Computing, collaborative Computing), Client Server Network and Peer to Peer Network, Network Topologies (Bus, Mesh, Star, Ring), Various types of computer Network (LAN, MAN, WAN), Types of switching network (Circuit and Packet), Need of layered mechanism, OSI Model (brief description of each layer), TCP/IP Model(brief description of each layer).

Unit-3: Physical View of ICT; Multiplexing, Definition and need, Time Division Multiplexing, Frequency Division Multiplexing, Code Division Multiplexing, Orthogonal Frequency Division Multiplexing, Identification of various transmission media, Wired media (Coaxial, Twisted Paid cable and their connectors), Wireless media (Microwave, Radio), Application of wireless media in satellite Communication, block diagram, important Definitions, Network Connecting devices (Switch, Router, Repeater, Bridges, Gateway) 3.4 IEEE standards for LAN(Introduction only).

Unit-4: Network Addressing; IPv4 addressing, Need of IP address, IPv4 addressing scheme, Address space and notations, Mask, netid, hosted, Sub-netting and super-netting, Classful and classless notations, Network address translations, IPv6 addressing, Need for IPv6 migration, IPv6 addressing scheme, Hexadecimal column notation, Uni-cast addresses, multicast addresses, anycast addresses Reserved addresses and local addresses, Address mapping (logical to physical, physical to logical), Ping and trace-route commands.

Unit-5: Protocols and Data Transportation; UDP and TCP protocols, Connectionless and connection oriented communication, Reliable and Unreliable communication UDP and TCP protocols, Data traffic and congestion semanagement, DNS, Domain, domain name, domain zone, root server, Domain types, Address resolution, Address mapping, Address, mapping address to names, recursive resolution, iterative resolution, caching) Protocols(introduction only), Data link layer protocols,

ARP,RARP,ICMP protocols (only brief explanation), Routing (brief explanation), Routing table, Unicast routing protocols and multicast routing protocols), SMTP, POP, IMAP, WWW and HTTP.

Text Books:

1. Richard Heeks, "Information and Communication Technology for Development". Routledge; 1 edition (November 7, 2017)
2. Nureni and Yekini "Information Communication Technology", Hasfem Publication center Shomolu
3. Sreekumar T.T., "ICTs and Development in India", Anthem Press. Ravichandran A. "Fundamentals of Information Technology", Khanna Publishers
4. James Irvine and David Harle "Data Communications and Networks", Wiley-Blackwell; 1 edition (22 October 2001)
5. Achyut S. Godbole and Atul Kahate "Data Communications and Networks", 2nd Edition,June 13, 2011, McGraw-Hill Education
6. Keshav S. "An Engineering Approach to Computer Networking", Pearson Education India; 1 edition (2002)
7. Prakash C. Gupta, "Data Communication and Computer Networks", 2nd Edition, Jan 2014 PHI Learning Pvt. Ltd.

Course Outcomes
At the end of the course the students shall be able
CO1 To understand the importance of information and information communication technology.
CO2 To understand basic concept of analog communication.
CO3 To Identify network, severs, topologies and networking component
CO4 To understand protocols and IEEE standards
Course Outcomes and their mapping with Programme Outcomes: ICT for Development (Open Elective -1X) (CE06TOE01D)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										3	2	1
CO2	3	2	2								3		3	2	2
CO3	2	2	1										3	1	2
CO4	2	2	2										2	1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE06PPC06	0	0	3	-	-	30	20	50	1.5
Subject:	Environmental Engineering Lab									

Course Learning Objectives:
The objective of this Course is
- To determine the physical, chemical and biological characteristics of water and wastewater through practical tests.
- To determine optimum dosage of coagulant and other critical tests to find the quality of water.

Course Content:
    Determination of the following Parameters in the given Water Sample:

1. Turbidity by Nephelometer.
2. TDS and fixed solids by Gravimetric method.
3. pH using pH-meter.
4. Carbonate, Bi-Carbonate & Hydroxide Alkalinity.
5. Dissolved Oxygen [DO] using DO meter.
6. Concentration of Chlorides.
7. Optimum coagulant dose for coagulation by Jar test apparatus.
8. Chlorine Demand of Water.
9. Total Hardness and Calcium Hardness.
10. Study of Weather Monitoring Station.
11. Study of Sound Level Meter.

Course Outcomes

CO1   Students will be able to know the procedure for quantifying quality parameters for water and sewage.

Course Outcomes and their mapping with Programme Outcomes: Environment Engineering Lab (CE06PPC06)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1				1	1			1	1		2	1	

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VI)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE06PPC07	0	0	3	-	-	30	20	50	1.5
Subject:	Computer Applications in Civil Engg. Lab									

Course Learning Objectives:

The objective of this Course is
- To understand the need for software tools for analysis and design of Civil Engineering Structures.
- To use the software tools for Modelling, Analysis and Design of Civil Engineering Structures

Course Content:
Minimum 10 problems to be solved either by using STAAD Pro/Excel Programming

USING MS EXCEL Programs
1. Analysis of simple beams
2. Design of simply supported RCC beams
3. Design of columns
4. Design of isolated footing (Flat, stepped and sloped)
5. Design of combined footings
6. Design of cantilever retaining walls
7. Design of slabs (one way and Two way)

USING STAAD Pro
8. Analysis of simple beams and Frames (2-D)
9. Analysis of multi storey frames for DL and LL
10. Analysis of multi storey frames for DL, LL, WL/EQL
11. Design of structural elements
12. Analysis and design of combined footing
13. Analysis and design of roof truss
14. Analysis of simple beams for rolling loads

Course Outcomes
At the end of the course the students shall be able
CO1 The students shall be able to analyse, determinate and Indeterminate Civil Engineering Structures.
CO2   To design various RCC components of buildings and other Civil Engineering Structures

Course Outcomes and their mapping with Programme Outcomes: Computer Applications in Civil Engg. Lab (CE06PPC07)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3								3	2	2
CO2	3	2	3	2	2								3	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

<u>Scheme & Syllabus</u>
<u>(IVth Year)</u>
B.Tech.
(Civil Engineering)
VII-SEM. to VIII-SEM.

SCHEME OF B.TECH.VII SEMESTER CIVIL ENGINEERING (New CBCS)
W.E.F. 2021-22 (ODD SEMESTER)

S.No.	Course No.	Subject Theory	Periods			Evaluation Scheme			Credits
			L	T	P	IA*	ESE	Total	
1	CE07TPC17	Water Resources Engineering-II	3	0	0	30	70	100	3
2	CE07TPE02	Professional Elective -02X	3	0	0	30	70	100	3
3	CE07TPE03	Professional Elective -03X	3	0	0	30	70	100	3
4	CE07TPE04	Professional Elective -04X	3	0	0	30	70	100	3
5	CE07TPE05	Professional Elective -05X	3	0	0	30	70	100	3
6	CE07TOE02	Open Elective -02X	3	0	0	30	70	100	3
Practicals									
1	CE07PPC08	Seminar*	-	-	3	50	-	50	1.5
2	CE07PPC09	Minor project	0	0	6	60	40	100	3
3	CE07PPC10	Estimation and Costing	0	0	3	30	20	50	1.5
		TOTAL					Total Credits		24

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam; * Seminar on Industrial Training/Internship undergone during summer vacation of 6th Semester

SCHEME OF B.TECH.VIII SEMESTER CIVIL ENGINEERING (New CBCS)

S.No.	Course No.	Subject Theory	Periods			Evaluation Scheme			Credits
			L	T	P	IA*	ESE	Total	
1	CE08TPC18	Earthquake Resistant Design of structure	3	0	0	30	70	100	3
2	CE08TPE06	Professional Elective -06X	3	0	0	30	70	100	3
3	CE08TPE07	Professional Elective -07X	3	0	0	30	70	100	3
4	CE08TOE03	Open Elective -03X	3	0	0	30	70	100	3
Practicals									
1	CE08PPC11	Major Project	0	0	14	120	80	200	7
2	CE08PPC12	Structural Detailing Lab	0	0	3	30	20	50	1.5
		TOTAL					Total Credits		20.5

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject Code:	CE07TPC17	3	0	0	15	15	30			
Subject:	Water Resources Engineering-II									

Course Learning Objectives:

- Introduce the types of dams and its failure criteria for structural stability
- Introduce the concepts of spillways and energy dissipaters
- Discuss the concept of diversion Head-works and understand design theory of seepage flow
- Introduce the concepts of regulation works, falls and hydraulic gates of spillways
- Know the concepts and design principles of Cross Drainage Works

Course Content:

UNIT 1: Dams: Types of Dams, Forces, failure of dams and criteria for structural stability, principle and shear stress, stability analysis, Elementary profile of a gravity dam, Profile from practical considerations, Openings in dams.

UNIT 2: Spillways and Energy Dissipaters: Introduction, essential requirements of a spillway, spillway capacity, components, Types of spillways, Ogee Spillway, Energy Dissipation below spillways, Types of Energy dissipater, USBR and Indian stilling basins.

UNIT 3: Diversion Head-works: Introduction, Types of diversion works, location and components, Weir and Barrage, Effect of construction of weir on the river regime, Bligh's creep theory, Theory of seepage flow, Khosla's theory, Vertical drop Weir.

UNIT 4: Regulation Works: Introduction, Definition of falls, necessity and location of falls, comparative study of the main types of falls. Hydraulic Gates: Spillway gates, types, tainter gates, Roller gates.

UNIT 5: Cross Drainage Works: Introduction, suitability, various types of C-D Works, Design principles of C-D Works

Text Books:
1. Irrigation Engineering and Hydraulic Structures – S.K. Garg (Khanna Publications)
2. Irrigation Engineering – B.C. Punmia (Laxmi Publications)
3. Irrigation, Water Resources and Water Power Engineering – Dr. P.N. Modi (Standard Book House)

Course Outcome
CO1   Explain the various forces acting on gravity dam and its stability analysis
CO2   Design of ogee spillway and getting concept of energy dissipation
CO3   Explain the diversion head-works and the theory of seepage flow
CO4   Demonstrate the concept of regulation works, falls and spillways gates
CO5   Apply the basic design principles of Cross Drainage Works

Course Outcomes and their mapping with Programme Outcomes: Water Resources Engineering-II (CE07TPC17)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

List of Professional (Core) Electives-2(PE-Group 2)

SYLLABUS								
Subject Code:	CE07TPE02X	CREDITS: 3			SESSIONAL - TA			ESE
Subject:	Professional Elective -2X	L	T	P	CT-1	CT-II	TOTAL	70
		3	0	0	15	15	30	
Professional Elective-2A or Professional Elective-2B or Professional Elective-2C or Professional Elective-2D or Professional Elective-2E	Any one subject to be Selected from the Professional Electives Group-2							
Professional Electives Group -2								
CE07TPE02A	Pre-stressed Concrete							
CE07TPE02B	Construction Engineering Materials							
CE07TPE02C	Disaster Preparedness and Planning							
CE07TPE02D	Advanced Structural Analysis							
CE07TPE02E	Low Cost Housing Techniques							

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TPE02A	3	0	0	15	15	30	70	100	3
Subject:	Pre-stressed Concrete									

Course Learning Objectives:

- To introduce fundamental of pre stressing and develop understanding of pre stressing system.
- To determine loss of pre stress in pre tensioned and post tensioned members as per IS Code provision.
- To analyze simple and composite section in flexure.
- To evaluate deflection in beam and design simply supported beams as per IS Code provision.
- To design the members for shear reinforcement, Ultimate Shear Strength and end block design.

Course Content:

UNIT 1:Introduction: Fundamentals of prestressing - Classification and types of prestressing- Concrete Strength and strain characteristics - Steel mechanical properties - Auxiliary Materials like duct formers.
UNIT 2: Prestressing Systems: Principles of pretensioning and post tensioning - study of common systems of prestressing for wires strands and bars. Losses of Prestress: Losses of prestress in pre tensioned and post tensioned members - I.S. code provisions.
UNIT 3: Analysis of Sections: In flexure, simple sections in flexure, kern distance - cable profile - limiting zones - composite sections cracking moment of rectangular sections.
UNIT 4: Deflection of Beams: Long term and Short term deflection and Design of Simply Supported Beams, Allowable stress as per I.S. 1343 - elastic design of rectangular and I-sections.
UNIT 5: Shear and Bond: Shear and bond is prestressed concrete beams - conventional design of shear reinforcement - Ultimate shear strength of a section - Prestress transfer in pretensioned beams-Principles of end block design.
Text Books:
 1.Krishna   Raju.   N   "Prestressed   Concrete",   Tata   Mc   Graw   Hill.
 2.Lin.T.Y,   "Prestressed   concrete",   Mc   Graw   Hill   Pub.   Co.
 3. Rajagopalan, "Prestressed concrete", Narosa Publishing House.

Course Outcomes-
CO1   Describe mechanical properties of pre stressed concrete, types of pre stressing and its system.
CO2   Calculate losses in pre-tensioned and post tensioned members.
CO3   Analyze pre-stressed concrete members for flexure, shear and cracking moment.
CO4   Design pre stressed concrete beams of rectangular and I section and compute deflection.
CO5   Explain principle of end block design, pre stress transfer, shear and bond.

Course Outcomes and their mapping with Programme Outcomes: Pre-stressed Concrete (CE07TPE02A)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TPE02B	3	0	0	15	15	30	70	100	3
Subject:	Construction Engineering Materials									

Course Learning Objectives:

- To introduce various construction materials on the basis of various classifications.
- To understand about various mortar making materials & its classification.
- To understand the emerging role of using polymers as construction material.
- To introduce about various modern construction materials.

Course Content:

UNIT-1 Construction Materials
Classifications of Construction Materials. Consideration of physical,Mechanical, thermo-physical Properties, characteristics behaviour under stress, Selection criteria for construction materials, green building materials.
UNIT–2Materials for making Mortar and concrete
Lime manufacture, properties, hardening of lime, types of lime, lime concrete uses. Cement, pozzolanic material, aggregates, water, admixtures - characteristics, properties and uses. Types of mortars, special mortars, their properties and applications.
UNIT-3 Polymers in civil engineering
Rubber and plastics, properties, effect of temperature on mechanical properties. Uses and application. Polymers, fibres and composites, Fibre reinforced plastic. Architectural use and aesthetics of composites. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites
UNIT- 4 Metals & Ceramics
Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel, Corrosion of concrete and reinforcing steel in various environments. Ceramic Materials: Classification, Refractories, glass, glass wool, mechanical, thermal and electrical properties, fire resistance materials, Uses and application.
UNIT V MODERN MATERIALS
Glass – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles– Geomembranes and Geotextiles for earth reinforcement.
Text Books:
1. Rangawala S.C. Engineering Materials Chortor Publications 1991.
2. S.K. Duggal Building Materials, New Age International Publications 2006.
3. Bruntley L.R Building Materials Technology Structural Performance & Environmental Impact McGraw Hill Inc 1995.
4. R Chudley Construction Technology, Vol I - IV Longman Group Construction Ltd. 1973.

Course Outcomes-On completion of this course the student will be able:
CO1 To remember & understand about various physical, Mechanical, thermo-physical Properties of various construction materials.
 CO2 To Acquire knowledge about composition, microstructure, and engineering behavior of various materials used in civil engineering applications.
CO3 To understand about various Mortar & Concrete producing materials
CO4 To Remember & understand about modifications possibilities in construction materials.

Course Outcomes and their mapping with Programme Outcomes: Construction Engineering Materials (CE07TPE02B)

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

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE02C	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Disaster Preparedness and Planning	3	0	0	15	15	30			

Course Learning Objectives:

1. Provide an understanding of the social nature of natural hazards and disasters.
2. Give students knowledge of the social factors affecting disaster mitigation, preparedness, response, and recovery.
4. Reveal unfounded myths about human behaviour in disasters.
5. Increase awareness of hazards and disasters around the world and the unequal social consequences stemming from disaster events.
6. Teach students skills to use information technology to access current disaster-relevant information for assessing, planning, mitigating, responding to and recovery from disaster from local through global levels.

Course Content:

UNIT-1 Introduction –Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation.

UNIT–2 Disaster Impacts –Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-3 Disaster Risk Reduction (DRR)– Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT- 4 Structural and non-structural safety measures

UNIT- 5 Development vs Sustainable Development

Text Books:
1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: Techniques and Guidelines, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Course Outcomes-
The student will develop competencies in
  CO1   the application of Disaster Concepts to Management
  CO2   Analyzing Relationship between Development and Disasters.
  CO3   Ability to understand Categories of Disasters
  CO4   realization of the responsibilities to society

Course Outcomes and their mapping with Programme Outcomes: Disaster Preparedness and Planning (CE07TPE02C)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1			2						2	2	
CO2	3	3	2	2	2								3	2	
CO3	3	3	3	2	3	2	2						3	3	
CO4	1	1				3	2								

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE02D	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Advanced Structural Analysis	3	0	0	15	15	30			

Course Learning Objectives:

- To learn stiffness method for analyzing determinate and indeterminate structure.
- To study general theory regarding beams subjected to concentrated and distributed loads.
- To analyze curved beams in plane.
- To understand symmetrical and non-symmetrical bending of straight beams.
- To define basic fundamental of structural dynamics.

Course Content:

UNIT-1: Direct stiffness method Introduction - element stiffness matrix - rotation transformation matrix - transformation of displacement and load vectors and stiffness matrix - equivalent nodal forces and load vectors - assembly of stiffness matrix and load vector - determination of nodal displacements and element forces - analysis of plane truss - plane frame (with numerical examples) - analysis of grid - space-truss and space-frame (without numerical examples) - computer Implementation - introduction to analysis packages (A project on development of an analysis program using above method is envisaged at this stage)

UNIT-2: Beams on elastic foundation: general theory - infinite beam subjected to concentrated load - boundary conditions - infinite beam subjected to a distributed load segment - semi-infinite beam subjected to loads at its end - semi-infinite beam with concentrated load near its end - short beams.

UNIT-3: Beams curved in plane: Analysis of cantilever beam curved in plan - analysis of circular beams oversimple   supports

UNIT-4:Non-symmetrical bending of straight beams: Shear centre – a review, symmetrical and non-symmetrical bending - bending stresses in beams subjected to non-symmetrical bending - deflections of straight beams subjected to unsymmetrical bending - fully plastic load for unsymmetrical bending.

UNIT-5:   Introduction   to   Structural   Dynamics
Single degree of freedom – un-damped and damped vibration-free vibration - forced vibration, introduction   to   multi   degree   of   freedom   systems.

Text Books:
1. Wang, C. K., Matrix Methods of Structural Analysis, International Textbook Company, 1970.
2. Przemeineicki, J. S., Theory of Matrix Structural Analysis, McGraw Hill, New York, 1985.
3. Weaver, W., and Gere, J. M., Matrix Analysis of Framed Structures, CBS Publishers, 2004.
4. Rajasekaran, S., and Sankarasubramanian, G., Computational Structural Mechanics, PHI
5. Boresi, A. P. and Sidebottom, O. M., Advanced Mechanics of Materials, John Wiley and Sons, 2003.
6. Srinath, L. S., Advanced Mechanics of Solids, Tata McGraw Hill, 2009.
7. Timoshenko, S., Strength of Materials, Part II, CBS Publishers, 2002.
8. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2007.
9. Paz M., Structural Dynamics, CBS Publishers, 2007.
10. Meirovich, L., Elements of Vibration Analysis, McGraw Hill, 2007.

Course Outcomes-

CO1   To interpret force-displacement relationship in truss, space frame etc. using direct stiffness method.
CO2   To investigate semi-infinite & infinite beam subject to concentrated and distributed loads.

CO3   To analyze circular and cantilever beams curved in plane.

CO4   To explain symmetrical and non-symmetrical bending of straight beams.

CO5   To outline basic fundamental of structural dynamics; free & forced vibration and multi degree of freedom systems.

Course Outcomes and their mapping with Programme Outcomes: Advanced Structural Analysis (CE07TPE02D)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE02E	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Low Cost Housing Techniques	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce various housing technique adopted in different zones in country.
- To study various uses of cost effective Technologies.
- To learn needs and innovations of building techniques for low cost construction.
- To learn space norms for low cost construction.
- To learn about building materials and costing of low cost construction.

Course Content:

UNIT-1 An introduction to the subject to understand the various building techniques adopted in different climatic zones of the country, which resulting in varied vernacular expressions.

UNIT–2 Use of cost effective technologies through the use of local materials, up gradation of traditional technologies, prefabrication etc.

UNIT-3 Need for low cost construction, both in the rural and the urban sectors. Innovations of building techniques for low cost construction.

UNIT- 4 Analysis of space norms for low cost buildings. Study of usages pattern of low cost buildings by the habitants.

UNIT- 5 Comparative analysis of building materials and costing. Works of Laurie Baker, Hassan Fathy and other prominent architects.

Text Books:
1. "Building Systems for Low Income Housing", Ashok Kumar Jain; Management Publishing House, 1992
2. "Low Cost Housing in Developing Countries", Guru Charan Mathur; For Centre for Science & Technology of the Non-Aligned and Other Developing Countries, Oxford & IBH Publishing Company, 1993

Course outcomes:
Upon completion of this course students will be able to
CO1   To classify various housing techniques adopted in different zones in country.
CO2   To identify various uses of cost effective Technologies.
CO3   To understand needs and develop innovations of building techniques for low cost construction.
CO4   To explain space norms for low cost construction.
CO5   To analysis about building materials and costing of low cost construction.

Course Outcomes and their mapping with Programme Outcomes: Low Cost Housing Techniques (CE07TPE02E)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

List of Professonal (Core) Electives-3(PE Group-3)

SYLLABUS (SEMESTER-VII)								
Subject Code:	CE07TPE03X	CREDITS:3			SESSIONAL - TA			ESE
Subject:	Professional Elective -3X	L	T	P	CT 1	CT 2	TOTAL	70
		3	-	-	15	15	30	
Professional Elective-3A or Professional Elective-3B or Professional Elective-3C or Professional Elective-3D or Professional Elective-3E	Any one subject to be Selected from the Professional Electives							
Professional Electives Group -3								
CE07TPE03A	Environmental Geo-technology							
CE07TPE03B	Air Pollution Control Engineering							
CE07TPE03C	Solid and Hazardous Waste Management							
CE07TPE03D	Design of Hydraulic Structures							
CE07TPE03E	Environmental Impact Assessment and Life Cycle Analysis							

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TPE03A	3	0	0	15	15	30	70	100	3
Subject:	Environmental Geo-technology									

Course Learning Objectives:
- Learning various soil engineering for land reclamation purposes, conversion of degraded waste land in new land use.
- Understanding land degradation and soil pollution and their restoration.
- Integration of engineering techniques with ecological process for restoration of productivity.

Course Content:

UNIT-1 Soil and ground water pollutants - their sources, nature, composition and polluting effects. The physico-chemical aspects of soils contaminated by various pollutants. Effects of environment and wastes on the properties of soils.

UNIT–2 Solid and liquid wastes disposal method and management. land treatment systems.

UNIT-3 Man made changes in geotechnical environment - mining, embankments, pumping, reservoir, landfills and reclamation effects and control.

UNIT- 4 Control of contamination with use of clay barriers, geosynthetics, cut-off walls, leachate collection systems.

UNIT- 5 Stabilization - different materials and techniques in control of ground pollution and treatment.

Text Books:
1. D.E.Daniel, Geotechnical Practice for Waste Disposal, Chaman & Hall, London, 1993
2. Hsai_Yang Fang and Daniels, J.L. Introductory Geotechnical Engineering an Environmental Perspective, Taylor & Francis, Oxon., 2006.
3. Lakshmi N. Reddy, Hilary. I. Inyang – Geo-Environmental Engineering – Principles and Applications – Makcel Dekker Ink, 2000
4. Mitchell, J.K. and Soga, K., Fundamentals of Soil Behaviour, John Wiley & Sons, Inc., New Jersey., 2005.
5. Mohamed, A.M.O. and Antia, H.E., Geo-environmental Engineering, Elsevier, Netherlands, 1998.
6. Reddy, L.N. and Inyang. H. I., Geo-environmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000.
7. Yong, R. N., Geo-environmental Engineering: Contaminated Soils, Pollutant Fate and Mitigation", CRC press LLC, Florida., 2001.

Course Outcomes-

At the end of the course the student will be able to:
- CO1 Understanding causes of soil pollution.
- CO2 Understand the fundamentals of soil behavior under varied environmental conditions.
- CO3 Identify contaminant transport mechanisms in soils.
- CO4 Specify site investigation techniques in the characterization of the contaminated site
- CO5 Understand remediation techniques to reclaim degraded land for conversion in to various land uses.

Course Outcomes and their mapping with Programme Outcomes: Environmental Geo-technology (CE07TPE03A)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TPE03B	3	0	0	15	15	30	70	100	3
Subject:	Air Pollution Control Engineering									

Course Learning Objectives:

The objective of this course is to:

- Comprehend the essential concepts of ambient air pollution and pollution control
- Make aware of techniques and instrumentation of ambient air monitoring, establishment of ambient air monitoring stations, stack monitoring
- Explore the experimental analysis of air gaseous and particulate air pollutants; standards and limits.

Course Content:

Unit1: INTRODUCTION:Sources and classification of Air pollutants: Natural contaminants,Aerosols, Gases & Vapors; Primary & Secondary Air pollutants; Stationary &Mobile Sources.Meteorology and Air pollution: Factors influencing Air pollution;Atmospheric stability & temperature inversions; Mixing height; Plumebehavior; Wind rose; Stack effluent dispersion theories; Stack height.

Unit 2:SAMPLING PROCEDURES: Sampling Methods, Difficulties in sampling,Stages & considerations of air sampling, Instruments for sampling wastegases & atmosphere, sampling period & methods, High volume sampler,Stack sampling techniques, selection of sampling location, procedure forcollection & sampling of particulate matter, Gaseous sampling, recenttrends in sampling of stack effluents.

Unit 3:Control of Particulates / aerosols: Objectives & types of Collectionequipment; Principle, application, working, advantages & disadvantages of:i) Settling chambers, ii) Inertial separators, iii) Cyclones, iv) Filters, v)Electrostatic Precipitators & vi) Scrubbers; Choice of equipment.

Unit 4: Control of Smoke -Gaseous Contaminants &Odour:Smoke: Sources, measurement by Ringelman chart, miniature chart &;other method; Prevention & control of smoke. Control of exhaustemissions.Gaseous Contaminants: Methods of control viz combustion, absorption,adsorption, closed collection & masking.Odour Control.

Unit 5:Control measures for Industrial Applications:Introduction to control of air pollution by process changes.Control measures for industries such as Cement Industry, Concretebatching plant, Asphaltic concrete plant, Glass manufacture, Asbestosprocessing, Thermal Power plant and Coal tar industry.

Text Books:
1.Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2.Martin Crawford: Air Pollution Control Theory.
3.Wark and Warner: Air Pollution: Its Origin and Control.
4.M.N.Rao & HVN Rao, Air Pollution, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5.Environmental Pollution Control Engineering- CS Rao, Wiley Eastern Ltd., New Delhi, 1996.
6.Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987
7.Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.
8.Suess and Craxford: W.H.O. Manual on Urban Air Quality Management

Course Outcomes-
After studying the course, the students will be able to

CO1 Understand & attribute air pollution, its driving forces, meteorological influence, impacts and control options.
CO2 Identify sampling techniques and analyze the air pollutants in ambient air & chimney.

CO3 Determine the stack height, assess the plume behavior and apply dispersion model for computing pollutant concentration.
CO4Understand the sources, measurements and control techniques for smoke and odour nuisance.
CO5 Apply different control measures in Industrial air pollutant emissions.

Course Outcomes and their mapping with Programme Outcomes: AirPollutionControl Engineering (CE07TPE03B)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TPE03C	3	0	0	15	15	30	70	100	3
Subject:	Solid and Hazardous Waste Management									

Course Learning Objectives:

- To define and characterize municipal solid wastes from technical and regulatory points of view.
- To provide comprehensive ways of collection, transportation and management of different types of solid wastes.
- To classify the waste and remove hazardous wastes; apply different methods of management.
- .To introduce the most common techniques for hazardous waste disposal.
- To use laboratorial tests in sampling & characterization of solid wastes.

Course Content:

UNIT-1:Municipal Solid Waste Management: Legal and Organizational foundation: Definition of Solid Waste, Waste Generation Technological Society, Major Legislation, Monitoring Responsibilities, Sources and Types of Solid Waste, Sampling and Characterization – Determination of Composition of MSW, Storage and Handling of Solid Waste ,Future Changes in Waste Composition.

UNIT-2:Collection and Transport of Solid Waste: Collection of Solid Waste: Type of Waste Collection Systems, Analysis of Collection System, Alternative Techniques for Collection System, Separation, Processing and Transformation of Solid Waste: UNIT Operations User for Separation and Processing, Materials Recovery Facilities, Waste Transformation through Combustion and Aerobic Composting, Anaerobic Methods for Materials Recovery and Treatment, Energy Recovery.

Incinerators Transfer and Transport: Need for Transfer Operation, Transport Means and Methods, Transfer Station Types and Design Requirements, Landfills, Site Selection, Design and Operation, drainage and Leachate Collection Systems , Requirements and Technical solution, Designated Waste Landfill Remediation, Integrated Waste Management Facilities.

UNIT-3:Hazardous Waste Management: Definition and Identification of Hazardous Wastes-Sources and Characteristics, Hazardous Wastes in Municipal Waste ,Hazardous Wastes Regulations ,Minimization of Hazardous Waste-Compatibility, Handling and Storage of Hazardous Waste-Collection and Transport, e-waste Sources, Collection, Treatment and Reuse Management.

UNIT-4:Hazardous waste treatment and Design: Hazardous Waste Treatment Technologies, Design and Operation , Facilities for Physical, Chemical and Thermal Treatment of Hazardous Waste –,Solidification, Chemical Fixation and Encapsulation, Incineration, Hazardous Waste landfills: Site Selection, Design and Operation, Remediation of Hazardous Waste Disposal Sites.

UNIT-5:Laboratory Practice: Sampling and Characterization of Solid Wastes; TCLP Tests and Leachate Studies.

Text Books:

1) Integrated Solid Waste Management by George Techobanoglous et al, McGraw-Hill Publication, 1993.
2) Hazardous Waste Management by Charles A. Wentz, McGraw Hill Publication, 1995.

Reference Books:

1)Solid and Hazardous Waste Management by S.C. Bhatia, Atlantic Publishers; Edition (1 December   2007).
2) Solid and Hazardous Waste Management by M.N Rao & Razia Sultana,BS Publications, Second Edition (2020)

Course Outcomes- At the end of the course completion, the students shall be able to:

CO1 Ability to characterize municipal solid wastes from technical view.
CO2 Learn ways of collection ,transportation and management of different types of solid wastes.
CO3 Apply different methods of managements for hazardous wastes.
CO4 Develop most suitable techniques for disposal of hazardous wastes.
CO5 Learn different laboratorial tests for solid wastes.

Course Outcomes and their mapping with Programme Outcomes: Solid and Hazardous Waste Management (CE07TPE03C)

| COs | POs | | | | | | | | | | | | PSOs | | |
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	2	2					1	3	2	
CO2	3	2	3	1	1	2	2					1	3	2	
CO3	3	2	2	1	1	2	3					1	3	2	
CO4	2	2	2	1	1	2	3					1	3	2	
CO5	3	3	2	1	1	2	3					1	3	2	

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject Code:	CE07TPE03D									
Subject:	Design of Hydraulic Structures	3	0	0	15	15	30			

Course Learning Objectives:

- Recognise the different types of dams, identify its purpose and function and to select the most appropriate dam.
- To introduce and give explanation the Principles of Design of Hydraulic Structures.
- To develop understanding for Analysis of gravity dam.
- To develop understanding about Earth dam and stability analysis.
- To introduce the importance of Spillways and energy dissipation systems.

Course Content:

UNIT 1: Introduction - Classification of dams, Gravity dams, Earth dams, Arch dam, Buttress dam, Steel dams, Timber dams, selection of site for dam, selection of type of dam, investigations of dam sites, Engineering surveys, Geological investigations, Types of hydropower plants, site selection for power plant, General arrangement of a hydropower project.

UNIT 2: Principles of Design of Hydraulic Structures - Hydraulic structures on permeable foundations, Theories of subsurface floor, Khosla's method of independent variables, Exit gradient, Location of Hydraulic jump, water surface profiles, scour due to subsurface flow, Design Principles, Energy dissipation principles.

UNIT 3: Gravity Dams - Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam, Finite Element Method, Design of gravity dam, joints in gravity dam, Galleries in gravity dam, Adits and shafts, Construction of gravity dam, Foundation Grouting, Instrumentation of gravity dams.

UNIT 4: Earth dams - Types of earth dams, Causes of failure of earth dams, Seepage analysis, phreatic line, flow net construction, criteria for safe design of gravity dams, typical cross sections of earth dams, Stability analysis, Seepage control, and design of filters.

UNIT 5: Spillways and energy dissipation systems - Essential requirements of spillways, Required spillway capacity, component parts of spillway, Types of spillways, Design of Ogee spillway, Design of shaft spillway, Design of siphon spillway, Design of stilling basins. Hydropower structures - Storage power plant, Runoff River plant, Pumped storage plant, Water conveyance systems, Tunnels and Penstocks, Gates, Surge tanks, Power house layout.

Text Books:

1. Golze, A. R., Handbook of Dam Engineering, Von Rostrand Reinhold Co., 1977
Sharma, H.D., Concrete Dams, CBIP Publication, 1998.
3. Siddiqui, I H, Dams and Reservoirs: Planning, Engineering, Oxford University Press, USA, 2009.
4. Novak, P., Moffat, A. I. B., Nalluri, C and Narayan, R., Hydraulic Structures, Taylor & Francis, 2006.
5. Modi P.M., Irrigation Water Resources and Hydropower Engineering, Standard Publishing Company, New Delhi, 2000.
6. Arora K.L. Irrigation Water Resources Engineering, Standard Book Publishing Co., Delhi, 1996.

Course Outcomes-
CO1 Define different types of dams.
CO2 Describe the Principles of Design of Hydraulic Structures.
CO3 Explain the concept of Gravity Dams.
CO4 Explain the concept of Earth dams and its stability analysis.
CO5 Describe the concept of spillways and energy dissipation systems.

Course Outcomes and their mapping with Programme Outcomes: Design of Hydraulic Structures (CE07TPE03D)

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

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE03E	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Environmental Impact Assessment and Life Cycle Analysis	3	0	0	15	15	30			

Course Learning Objectives:

- Identify environmental attributes for the EIA study.
- Identify methodology and prepare EIA reports.
- Specify methods for prediction of the impacts.
- Formulate environmental management plans.
- Understand the concept of life cycle analysis (LCA) and the basic principles.

Course Content:

UNIT-1 Introduction: Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Public Participation in EIA. EIA process- screening – scoping - setting – analysis – mitigation

UNIT–2Components and Methods for EIA: Matrices – Networks – Checklists – Connections and combinations of processes – Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modelling for impact prediction – Assessment of impacts – air – water – soil – noise – biological –– Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation. EIA methods in other countries.

UNIT-3 Environmental Management Plan: Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

UNIT- 4 An Introduction to Sustainability Concepts and Life Cycle Analysis (Introduction, Material flow and waste management, What it all means for an engineer? Water energy and food nexus). Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems)

UNIT- 5Environmental Data Collection and LCA Methodology (Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology - Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools). Life Cycle Assessment – Detailed Methodology and ISO Framework (Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework)

Text Books:
1. Anjaneyulu.Y., and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
2. Canter, L.W., Environmental Impact Assessment, McGraw Hill Pub. Co., New York. 1997
3. David P. Lawrence, Environmental Impact Assessment: Practical Solutions to Recurrent Problems, John Wiley & Sons, 2003
4. Environmental Assessment, 2001. Ravi Jain, LV Urban, GS Stacey, H Balbach, McGraw-Hill.
5. Handbook on Life Cycle Assessment : Operational guide to the ISO standards, Kluwer Academic Publishers, 2004
6. Hosetti, B. B., Kumar A, Eds, Environmental Impact Assessment & Management, Daya Publishing House, 1998

7. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Inter science, New Jersey, 2003.
8. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.
9. Rau, GJ. And Wooten, C.D., Environmental Impact Analysis Handbook, McGraw Hill 1980
10. Wathern.P., Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.

Course Outcomes At the end of the course the student will be able to:

CO1 Identify environmental attributes for the EIA study.

CO2 Identify methodology and prepare EIA reports.

CO3 Specify methods for prediction of the impacts.

CO4. Understand EIA tools & methodologies, auditing and documentation of EIA

CO4 Formulate environmental management plans

CO5 Perform life cycle inventory analysis of products.

CO6 Develop strategies to bring energy efficiency in all stages of the product development cycle.

CO7 Formulate plans for comprehensive environmental protection, in order to comply with environmental laws

Course Outcomes and their mapping with Programme Outcomes: Environmental Impact Assessment and Life Cycle Analysis (CE07TPE03E)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		3	1	2						3	2	
CO2	3	3	1		3	1	2			3	2		3	2	
CO3	3	3	3	2	3	1	2			3	2		3	2	
CO4	3	3	3	3	3	1	2			3	2		3	2	
CO5	3	3	1	3	2	1	2				2		2	3	
C06	3	3	3	3	3	1	2			3	2		3	2	
C07	3	3	1		3	1	2			3	2		3	2	

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

List of Professional (Core) Electives-4(PE Group-4)

SYLLABUS (SEMESTER-VII)							
Subject Code:	CE07TPE04X	CREDITS:3		SESSIONAL - TA			ESE
Subject:	Professional Elective -4X	L	T	P	CT 1	CT 2	TOTAL	70
		3	-	-	15	15	30	
Professional Elective-4A or Professional Elective-4B or Professional Elective-4C or Professional Elective-4D or Professional Elective-4E	Any one subject to be Selected from the Professional Electives						
Professional Electives Group -4							
CE07TPE04A	Engineering Hydrology						
CE07TPE04B	Structural Dynamics						
CE07TPE04C	Foundation Engineering						
CE07TPE04D	Rock Mechanics						
CE07TPE04E	Water Resources Planning & Management						

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE04A	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Engineering Hydrology	3	0	0	15	15	30			

Course Learning Objectives:

- To develop the fundamentals of hydrology.
- To study the various forms of precipitation, evaporation and infiltration
- To know the types of Hydrograph and Rainfall-Runoff correlations
- To learn the Flood forecasting and Flood routing methods
- To understand the fundamentals of ground water hydrology

Course Content:

UNIT-1 Introduction- Description of Hydrologic Cycle, Overview of application of hydrology in engineering. Precipitation, Infiltration and Evapotranspiration Runoff and Hydrographs,

UNIT–2 Forms of precipitation, measurement, depth-area-duration and intensity-duration frequency relations, Evaporation - process, measurement, and estimation, Infiltration process, measurement, and estimation, Evapotranspiration measurement and estimation

UNIT-3 Rainfall Runoff correlations, Flow duration curve, Mass curve, Factors affecting flow hydrograph, Unit hydrograph, its analysis, and S-curve hydrograph, Synthetic and instantaneousunithydrographs.

UNIT- 4 Statistical analysis, Flood frequency studies, Flood forecasting, rational method, Time Area curves, Risk, reliability, and safety factor, Floodcontrolmeasures. Introduction to basic routing equations, Design flood, Channel and flood routing. Introduction to HEC-RAS software.

UNIT- 5 Occurrence of groundwater, types of aquifers, aquifer properties, Darcy's law, Conductivity and Transmissivity, yield from a well under steady state conditions,Laboratory and field measurement of permeability

Text Books:
1. Engineering Hydrology K.Subramanya, Tata McGraw-HillEducation
2. Hydrology Principles, Analysis and Design H.M.Raghunath, New AgeInternational
3. Hand Book ofAppliedhydrology V.T.Chow, McGraw-Hill,Inc
4. ViesmannWandLewisGLt(2008)"IntroductiontoHydrology".PrenticeHallofIndia
5. Ojha,C.S.P. , Bhunya, P. and Berndtsson, R.- Engineering Hydrology, Oxford University PressCanada.
6. K. C. Patra, Hydrology and Water Resources Engg., Narosa Publishing house, New Delhi.
7. D. K. Todd, Groundwater Hydrology, John Wiley and Sons

Course Outcomes-Upon completion of this course students shall be able to

CO1   Describe the basic concepts of hydrology and integrate the physical hydrological processes.

CO2   Explain the various process, measurement, and estimation of hydrological components

CO3   Formulate the runoff and hydrograph's estimation and apply into engineering practices.

CO4   Examine the various statistical methods for Flood studies and can investigate historical datasets.

CO5   Understand and explain the basics of groundwater hydrology.

Course Outcomes and their mapping with Programme Outcomes: Engineering Hydrology (CE07TPE04A)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject Code:	CE07TPE04B	3	0	0	15	15	30			
Subject:	Structural Dynamics									

Course Learning Objectives:

- To Introduce fundamentals of vibrations of SDOF system
- To Impart damped and undamped system
- To Present free and forced vibration
- To Acquaint with free and forced vibration of MDOF system
- To Present free and forced vibration of continuous system

Course Content:

UNIT- 1: INTRODUCTION: Comparison between static and dynamic analysis; Degrees of freedom; Undamped system; Newton's law of motion; 'D' Alembert's principle; Solution of the differential equation of motion.

UNIT-2: FREE VIBATION OF SINGLE DEGREE - OF - FREEDOM SYSTEM: Equation of motion for single degree - of - freedom system; free undamped vibration of the SDOF system; Damped single degree - of - freedom system -Viscous damping, Equation of motion, critically damped system, Over- damped system. Under-damped system and Logarithmic decrement.

UNIT-3: RESPONSE OF SDOF SYSTEM TO HARMONIC LOADING: Undamped harmonic excitation; Damped harmonic excitation; Evaluation of damping at resonance; Response to support motion; Force transmitted to the foundation. Response of' SDOF system to general dynamic loading: Impulsive loading and Duhamel's integral; Numerical evaluation of Duhamel's integral — Undamped system; Numerical evaluation of Duhamel's integral -Damped system.

UNIT-4: GENERALIZED COORDINATES AND RAYLEIGH'S METHOD: Principle of virtual work; Generalized SDOF system - Rigid body; Generalized SDOF system - Distributed elasticity; Rayleigh's method; Improved Rayleigh's method.

UNIT-5: STRUCTURES MODELED AS SHEAR BUILDINGS: Stiffness equations for the shear building; Flexibility equations for the shear building; Free vibration of a shear building (Single bay two Storeyed) - Natural frequencies and normal modes. Forced motion of shear buildings (Two Storeyed): Modal superposition method; Response of a shear building to base motion; Harmonic forced excitation.

Text Books/Reference Books:

1. Dynamics of Structures by A.K.Chopra, Second edition (2001), Prentice Hall India Private Ltd
2. Dynamics of Structures by Clough, R.W. & Penzin, J., McGraw Hill, 1993.
3. Earthquake Resistant Design of Structures by Pankaj Agarwal, Manish Shrikhande , 1st edition (2006), Prentice Hall of India Private Ltd., New Delhi .
4. Dynamics of Structures by Humar, J.L., Prentice Hall, 1990.
5. Structural Dynamics by Mario, Paz, CBS Publ. New-Delhi, 1995.
6. Advanced Dynamics by Timoshenko, S., McGraw Hill Book Co, NY, 1948.
7. Elements of Vibration Analysis by Meirovitch, L., 2nd Edi. McGraw Hill Intr. Edi.,Singapore, 1986.
8. Introduction of Structural Dynamics, Biggs, J.M., McGraw Hill, NY, 1964
9. Principles and techniques of vibrations by L Meirovich, 1997, Prentice Hall, NJ.
10. Analytical methods in vibrations by L Meirovich, 1967, Macmillan, NY.
11. Theory of vibrations by W T Thompson, 1983, Prentice hall, New Delhi
12. Vibration: fundamentals and practice by C W de Silva, 1999, CRC Press, Boca Raton.
13. Mechanical Vibrations by S S Rao, 2004, 4th Edition, Pearson Education, New Delhi.
14. Probabilistic theory of structural dynamics by Y K Lin, 1967, Mc-GrawHill.

15. Introduction to random vibrations, N C Nigam, 1983, The MIT press, Massachussets.

Course Outcomes:

On the completion of this course, the student will be able to

CO1 Convert a physical structure into SDOF system/model

CO2 Find response of free and force vibration (harmonic, periodic and transient) of SDOF system

CO3 Calculate natural frequency and mode shapes of MDOF system

CO4 Carry out modal analysis of MDOF system

CO5 Get the Response of structures by performing experiments and/or by computer simulation.

Course Outcomes and their mapping with Programme Outcomes: Structural Dynamics (CE07TPE04B)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TPE04C				15	15	30	70	100	3
Subject:	Foundation Engineering	3	0	0						

Course Learning Objectives:

- To introduction of different methods of soil exploration.
- To provide comprehensive studies of shallow foundation and calculate settlements.
- To analyze various types of footings & rafts.
- To introduction of various types of piles foundations and to calculate bearing capacity.
- To introduce Comprehensive studies of Retaining walls and determine stability.

Course Content:

UNIT-1 SITE INVESTIGATION AND SELECTION OF FOUNDATION

Scope and Objectives, Methods of Exploration , Auguring and Boring ,Wash Boring and Rotary Drilling ,Depth and Spacing of Bore Holes ,Soil Samples ,Representative and Undisturbed, Sampling Methods Split Spoon Sampler, Thin Wall Sampler, Stationary Piston Sampler ,Penetration Tests (SPT and SCPT) ,Data Interpretation ,Strength Parameters ,Bore Log Report and Selection of Foundation.

UNIT–2 SHALLOW FOUNDATION

Location and Depth of foundation, Codal Provisions, Bearing Capacity of Shallow Foundation on Homogeneous Deposits ,Terzaghi's Formula and BIS formula ,Factors Affecting Bearing Capacity Bearing Capacity from In-Situ Tests (SPT, SCPT and Plate Load) ,Allowable Bearing Pressure , Seismic Considerations in Bearing Capacity Evaluation, Determination of Settlement of Foundations on Granular and Clay Deposits ,Total and Differential Settlement , Allowable Settlements , Codal Provision , Methods of Minimizing Total and Differential Settlements.

UNIT-3 FOOTINGS AND RAFTS

Types of Isolated Footing, Combined Footing, Mat Foundation, Contact Pressure and Settlement Distribution, Proportioning of Foundations for Conventional Rigid Behavior, Minimum Thickness for Rigid Behavior, Applications, Compensated Foundation, Codal Provisions.

UNIT- 4 PILE FOUNDATION

Types of Piles and Functions ,Factors Influencing the Selection of Pile , Carrying Capacity of Single Pile in Granular and Cohesive Soil , Static Formula ,Dynamic Formulae (Engineering News and Hileys) ,Capacity from In-Situ Tests (SPT and SCPT) , Negative Skin Friction , Uplift Capacity, Group Capacity by Different Methods (Feld's rule, Converse — La-Barrae formula and Block Failure Criterion) ,Settlement of Pile Groups , Interpretation of Pile Load Test (Routine Test Only), Under Reamed Piles, Capacity under Compression and Uplift , Cohesive -Expansive ,Non Expansive — Cohesionless Soils , Codal Provisions.

UNIT- 5 RETAINING WALLS

Plastic Equilibrium in Soils ,Active and Passive States , Rankine's Theory for Cohesionless and Cohesive Soil ,Coulomb's Wedge Theory , Condition for Critical Failure Plane ,Earth Pressure on Retaining Walls of Simple Configurations , Culmann's Graphical method ,Pressure on the Wall due to Line Load ,Stability Analysis of Retaining Walls ,Codal Provisions.

Text Books:
1) Foundation Analysis and Design by J. E. Bowels, McGraw Hill. Companies, Inc. 6th Ed. 2001.
2) Principles of Foundation Engineering by B. M. Das, CENGAGE Learning. Seventh Edition.
3) Foundation Engineering Handbook by R. W. Day, McGraw Hill. ConstructionASCE Press. Ed. 2006.
Reference Books:
1) Basic and Applied Soil Mechanics by Gopal Ranjan & A.S. R. Rao, New Age International (P) Limited Publishers, New Delhi-110002.

2) Textbook of Soil Mechanics and Foundation Engineering –Geotechnical Engineering Series (PB 2018) by V.N. S. Murthy, CBS Publications, New Delhi
3) Soil Mechanics by Robert V. Whitman & T. William Lambe, Wiley India Pvt Ltd., New Delhi.
4) Soil Mechanics and Foundation Engineering (Geotechnical Engineering) by Dr. P.N. Modi, Standard Book House(Rajsons Publications Pvt Ltd), New Delhi-110002

Course Outcomes-At the end of the course completion, the students shall be able to:
CO1   Understand different methods of soil exploration.
CO2   Analyze various shallow foundations and calculate different types of settlements.
CO3   Understand various types of footings & rafts.
CO4   Analyze bearing capacity of piles with different methods
CO5   Design stability of Retaining walls.

Course Outcomes and their mapping with Programme Outcomes: Foundation Engineering (CE07TPE04C)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE04D	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Rock Mechanics	3	0	0	15	15	30			

Course Learning Objectives:
- To understand the basics of rock mechanics and able to analysis stress.
- To calculate strain and determine physical properties of rocks.
- To determine mechanical properties of rocks by different methods.
- To analyse different models of stress–strain in rocks.
- To determine the static & dynamic elastic constants of rocks.

Course Content:

UNIT – 1: INTRODUCTION TO ROCK MECHANICS
Definition, Scope, Importance & Development, Application in Mining, Discontinuities; Description of Discontinuities, Introduction to Mapping and Hemispherical Projection of Discontinuities, Barton's Shear Strength of Joints.
Analysis of Stress: Introduction, Definition and Basic Concepts, Stress in a Plane(2-D), Mohr's Circle of Stress, Secondary Principal Stress, Equations of Equilibrium, Plane Stress Equations.

UNIT – 2: ANALYSIS OF STRAIN
Introduction, Definition and Basic Concepts, Strain in a Pane (2-D), Mohr's Circle of Strain, Equations of Compatibility, Stress-Strain Relationship, Basic Equations in Elastic Theory, Pain Strain Equations, Elasto Plastic Behaviour of Rocks, Stress – Strain Curves of Various Rocks.
Physical Properties: Definition and Determination of Density, Hardness, Porosity, Permeability, Moisture Content, Degree of Saturation. Electrical and Thermal Properties of Rocks.

UNIT – 3: MECHANICAL PROPERTIES
Definition and Determination of Compressive Strength, Tensile Strength, Shear Strength, Triaxial Testing. Time Dependent Properties, Scaling of Laboratory Data to In-Situ Values.
Rock Indices: Protodyakanov Strength Index, Point Load Strength Index, RQD, In-Situ Strength Properties of Rocks, Necessity and Requirement, Methods of In-Situ Stress Measurements, Plate Load Test, Cable Jack Test, Bore Hole Test, Dilatometer Test, Flat Jack Test, Hydraulic Fracture and Velocity Propagation.

UNIT – 4: RHEOLOGICAL MODELS
Relationship and Rate of Change of Stress-Strain for Idealizing Materials – Models Representing Elastic, Plastic, Viscous, Elasto-Plastic, Non-Elastic and Brittle Rock Properties.

UNIT – 5: STATIC AND DYNAMIC ELASTIC CONSTANTS OF ROCKS
Static Elastic Constants of Rocks: Introduction, Definition, Instrument, Measurement of Deformation, Mechanical, Optical, Electrical Gauges, LVDT, Calculation of Elastic Constants of Rocks.
Dynamic Elastic Constants of Rocks: Introduction, Elastic Wave, Calculation of Modulus of Elasticity.

TEXT BOOKS:
1) Rock Mechanics for Engineers - B. P. Verma, 2nd edition, Khanna Publishers, 1989.
2) Strata Mechanics in Coal Mining - Jeremic, K. L. Jeremic, Rotterdam, Balkema, 1985.
3) Fundamentals of Rock Mechanics - Jager & Cook, Methuen andco. London, 1969.

REFERENCE BOOKS:
1) Hand Book on Mechanical Properties of rocks - R.D. Lama, V. S. Vutukuri, Vol. I to IV, Transtech Publications,1978.
2) Mechanics and Engineering - Charles Jaeger, Cambridge University Press, 1979.
3) Rock Mechanics for Underground Mining - 2nd edition, Brady and Brown, Kluwer Academic Publlishers, 1993.

4) Ground Mechanics in Hard rock Mining - M. L. Jeremic, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.
5) Rock Mechanics and Design of Structures in Rock - L. Obert & W.I. Duvall, John wiley and Sons, 1966.
6) Introduction to Rock Mechanics - R. E. Goodman, 2nd edition, John wiley and Sons, 1989.
7) The elements of Mechanics of Mining Ground - B. S. Verma Vol. I. Julin & Co. Lucknow 1981.
8) Engineering Rock Mechanics, An Introduction to the Principles - John A. Hudson and John. P. Harrison Pergamon Press 1997.

Course Outcomes: At the end of the course completion, the students shall be able to:
CO1 Learn basics of rock mechanics and calculate stresses.
CO2 Determine physical properties of rocks and strain.
CO3 Evaluate mechanical properties of rocks.
CO4 Compare stress strain in rocks by different methods.
CO5 Determine the static & dynamic elastic constants of rocks.

Course Outcomes and their mapping with Programme Outcomes: Rock Mechanics (CE07TPE04D)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE04E	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Water Resources Planning & Management	3	0	0	15	15	30			

Course Learning Objectives:

1. To learn how to assess water resources
2. To study how to develop suitable plans for water resources development and management
3. To understand various types of water resources systems.
4. To learn managing the water resources quality and quantity
5. To understand water quantity and quality modelling.

Course Content:

UNIT 1: Introduction: Role of water in national development, assessment of water resources of country, scope of water resources development vis-a-vis environment, Irrigation development in India, utilisation of Irrigation potential.

UNIT 2: Planning: Water resources planning process; planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives, cost-benefit analysis.

UNIT 3: Water Resources Systems: Definition, types of system, optimization techniques, system approach, system analysis, linear programming, and formulation of a linear programming problem, formulation with different types of constraints, graphical analysis, graphical solution, simplex method, optimization techniques and systems approach.

UNIT 4: Management: Evaluation and monitoring of water quantity and quality, managing water distribution networks for irrigation, flood control and power generation, inter-basin transfer of water, conjunctive use of surface and ground water.

UNIT 5: Modelling: Water quantity and quality modelling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentation and watershed management.

Text Books:

1. Principles of Water Resources Planning – Good Man, A.S., (Prentice Hall, Inc., Englewood Cliffs, N.J. 1984.)
2. Water Resources Systems -S Vedula and P P Mujumdar, Tata McGraw-Hill Education, 2005
3. James, L. Douglas, and Robert R. Lee, Economics of Water resources Planning, McGraw-Hill Book Company, 1971.
4. Quentin Grafton, R. and Karen Hussey, Water Resources Planning and Management, Cambridge University Press, 2011.
5. Water Resources System, Planning and Management – M.C. Chaturvedy (Tata McGraw Hill)
6. Water Resources System, Planning and Management – Helweg O.J. (John and Wiley & Sons)

Course Outcomes- after completion of the course the students shall be able to

CO1 Describe the potential of assessing water resources
CO2 Prepare master and strategic water resources planning
CO3 Apply the optimization techniques for water resources systems.
CO4 Exercise the management of water resources in different real life situations
CO5 Solve various water resources problems using modelling.

Course Outcomes and their mapping with Programme Outcomes: Water Resources Planning & Management (CE07TPE04E)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

List of Professional (Core) Electives-5 (PE Group -5)

Subject Code:	CE07TPE05X	CREDITS:3			SESSIONAL - TA			ESE
		L	T	P	CT 1	CT 2	TOTAL	70
Subject:	Professional Elective -5X	3	-	-	15	15	30	

<table>
<tr><td colspan="2" align="center">SYLLABUS
(SEMESTER-VII)</td></tr>
</table>

Professional Elective-5A or Professional Elective-5B or Professional Elective-5C or Professional Elective-5D or Professional Elective-5E	Any one subject to be Selected from the Professional Electives

Professional Elective-5 (PE Group-5)	
CE07TPE05A	Industrial Structures
CE07TPE05B	Airport Planning and Design
CE07TPE05C	Highway Construction and Management
CE07TPE05D	Contracts Management
CE07TPE05E	Construction Projects Planning & Systems

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject Code: CE07TPE05A		3	0	0	15	15	30			
Subject: Industrial Structures										

Course Learning Objectives:

The purpose of this course is to develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard.

Course Content:

UNIT: I Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations

UNIT: II Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations

UNIT: III Design of Pre-Engineered Buildings

UNIT: IV Power plant structures- Bunkers and silos- chimney and cooling towers- nuclear containment structures.

 UNIT: V Power transmission structures- transmission line towers- tower foundations- testing towers

TEXT BOOKS
 1. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company

REFERENCES:
1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings
3. Design of steel structures by N. Subramanian

Course Outcomes-
Course Outcomes: At the end of the course, the student will be able to -
CO1 Plan the functional requirements of structural systems for various industries.
CO2 Get an idea about the materials used and design of industrial structural elements.
 CO3 Realize the basic concepts and design of power plant structures.
CO4 Design power transmission structures.
C05 Possess the ability to understand the design concepts of Chimneys, bunkers and silos

Course Outcomes and their mapping with Programme Outcomes :Industrial Structures (CE07TPE05A)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TPE05B	3	0	0	15	15	30	70	100	3
Subject:	Airport Planning and Design									

Course Learning Objectives:

- To familiarize students with of airport planning.
- To develop the knowledge for design and analysis of airport runway, taxiway and airport pavement crust.
- To understand air traffic control system.

Course Content:

UNIT-1 Airport Planning: Significance of transport, Different modes of transportation, Airport master plan-FAA recommendation. Regional planning, airport site selection, survey for site selection, Estimation of future air traffic, Characteristics of aircraft, Environmental consideration.

UNIT–2 Runway Design: Orientation of runway , Basic runway length, Corrections for basic runway length, Runway geometric design

UNIT-3 Taxiway Design: Controlling factors of taxiway, Geometric design for taxiway, Design for exit taxiways.

UNIT- 4 Airport Pavement Design: Design factors, Design of flexible pavement, Design of rigid pavement, design of overlay pavements

UNIT- 5 Air Traffic Control and Visual Aids: Air traffic control objectives, control system. Visual aids-airport markings and lighting

Text Books:
1. Dr. S. K. Khanna, M.G. Arora and S.S. Jain, Airport Planning & Design, Nem Chand & Bros.,Roorkee
2. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
3. S.C. Rangwala and K.S, Rangwala, Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand

Course Outcomes-

After learning the course the students should be able to:
CO1 Understand the fundamentals of airport planning.
CO2 Familiarize with design of runway.
CO3 Recognize design of taxiway
CO4 Understand airport pavement design
CO5 Analyse air traffic control system.

Course Outcomes and their mapping with Programme Outcomes: Airport Planning and Design (CE07TPE05B)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE05C	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Highway Construction and Management	3	0	0	15	15	30			

Course Learning Objectives:
1. To familiarize students with highway construction materials.
2. To develop ability to pavement design.
3. To instruct students to concept of evaluation and strengthening of pavement.
4. To interpret students to concept of highway drainage.
5. To develop knowledge on concept of highway maintenance.

UNIT 1:Highway Materials: Soil, Desirable Properties, Classification, CBR, G. I., Modulus ofSubgrade Reaction, Aggregates and their Characterisations, Bituminous materials, Bituminous mixes, Concept of Superpave.

UNIT 2:Construction of Pavement: Highway Constructions - Earth Roads, Gravel roads, SoilStabilized Roads, WBM Roads, Bituminous roads. Surface dressing, Seal Coat, Tack,Coat, Prime Coat, Grouted Macadam, Premix Methods and their Construction Procedures Construction of Cement Concrete Pavement Slab.

UNIT 3:Evaluation And Strengthening: Flexible And Rigid Pavement Evaluation,Strengthening of Pavements, Design of Overlays

UNIT 4:Highway Drainage: Significance of highway drainage, requirements of highway drainage, Design of surface drainage system, Design of sub-surface drainage system, Road construction in water-logged areas.

UNIT 5:Highway Maintenance: Types of defects in Flexible and Rigid pavement, Causes and Treatment, Special repairs. Pavement Evaluation- Pavement surface conditions and Structural Evaluation.

Text Books:

1. S.K. Khanna and C.E.J. Justo, "Highway Engineering", Nem Chand Publication.
2. Partha chakrobarty & Animesh Das "Principles of Transportation Engineering",PHI.
3. Subhash C Saxena "textbook of Highway and traffic engineering" CBS publishers and distributions pvt. Ltd.
4. L.R.Kadiyali&N.B.Lal, "Principles & Practices of Highway Engg, Khanna Publishers.
5. Specification for Road and Bridge Works (Ministry of Surface Transport - Published by Indian Roads Congress.

Course Outcomes:
At the end of this course, the student will be able to
CO1 Identify the highway materials.
CO2 Design and analysis of pavement design.
CO3 Conduct and analysis of evaluation and strengthening of pavement.
CO4 Design and analysis of surface and sub-surface drainage system.
CO5 Use various repair techniques for highway maintenance.

Course Outcomes and their mapping with Programme Outcomes: Highway Construction and Management (CE07TPE05C)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE05D	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Contracts Management	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce about various Authorities, indulge in construction contract management.
- To impart knowledge on municipal bye-laws related to construction.
- To elaborate about construction contracts, arbitration, and litigation procedures

Course Content:

UNIT-1 Introduction and concepts of Construction law-public law-government departments and local authorities.

UNIT–2Private law-contracts-torts-property law and building law-concepts-salient features sections

UNIT-3 Construction contracts-contracts specifications-types of contract documents used for construction.

UNIT- 4 Contract procurement- selection of contractor-contract procedure-salient features.

UNIT- 5Arbitration and litigation procedure-preparation, settlement, evidence, price adjustment-need for the formulae-civil engineering and building formulae- practical implications.

Text Books:

1. Gajaria G. T., laws relating to building and engineering contracts in India, M. M Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze, construction contracts, 2nd edition. McGraw hill, 2001.
3. Joseph T. Bockrath, contracts and the legal environment for engineers and architects, 6th edition, McGraw Hill, 2000.

Course Outcomes-

1. To remember about various Authorities, indulge in construction contract management.
2. To understand about municipal bye-laws related to construction.
3. To remember & understand about various classifications of construction contacts.
4. To review about various steps of contract procurement in construction industry.
5. To evaluate the role of Arbitration and litigation procedure in settlement of contract related disputes.

Course Outcomes and their mapping with Programme Outcomes: Contracts Management (CE07TPE05D)

SNO	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
1	CO 1	2					3		2	3		2	3	3		
2	CO 2	2					3		2	3		2	3	3		
3	CO 3	2	1	2	2		3		2	3	1	2	3	3	2	
4	CO 4	2	1	2	2		3		2	3	1	2	3	3	2	
5	CO 5	2		2	2		3		2	3	1	2	3	3		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE05E	L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject:	Construction Projects Planning & Systems	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the project management and different scheduling techniques.
- To expertise in PERT network analysis.
- To learn CPM network analysis and compared with PERT.
- To understand time-cost analysis and resource scheduling.
- To understand the factor for equipment selection and cost of owing and operating and expertise in evaluation and analysis of different equipment life.

Course Content:

UNIT 1: Introduction: Objectives and functions of project management, project feasibility reports, Planning for construction projects: Steps, factors, advantages and disadvantages for different stake holder.

Scheduling: Scheduling Job layout and Line of balance, project management through networking, Bar Chart, Linked bar chart, Work-break down structures, Activity-on-arrow diagrams.

UNIT 2: PERT: Network analysis, critical path, probability of project.

UNIT3: CPM: Network analysis, Critical Path, Difference between CPM and PERT.

UNIT 4: Time-Cost Trade-off, Resource Scheduling

UNIT 5: Time and motion studies, Standard and special equipment, factors affecting selection of construction equipment, cost of owning and operating the construction Equipment, Equipment Life and Replacement Analysis

Text Books:
1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.
2. Srinath,L.S., "PERT and CPM Priniples and Applications ", Affiliated East West Press, 2001
3. Chris Hendrickson and Tung Au, "ProjectManagement for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
4. Moder.J., C.Phillips and Davis, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.
5. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi Willis., E.M., "Scheduling Construction projects", John Wiley and Sons 1986.
6. Halpin,D.W., "Financial and cost concepts for construction Management", John Wiley and Sons, New York, 1985.

Course Outcomes- At the end of the course students will be able to:
CO1 To apply the knowledge in managing and handling of different civil engineering project and also able to schedule the project.
CO2 To do PERT analysis and able to find the project completion time and its probability.
CO3 To do CPM analysis and able to find the project completion time and compare with PERT analysis.
CO4 To do cost and time analysis and also resource allocation, scheduling and crashing for different activities of the network.
CO5 To apply the knowledge in equipment selection and able to find cost of owing and operating and able to find the equipment life, which help in comparisons of different equipments.

Course Outcomes and their mapping with Programme Outcomes :Construction Projects Planning & Systems (CE07TPE05E)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

List of Open Elective-2 (OE-Group-2)

Subject Code:	CE07TOE02X	CREDITS:3			SESSIONAL - TA			ESE
		head SYLLABUS (SEMESTER-VII)						

Subject Code:	CE07TOE02X	CREDITS:3			SESSIONAL - TA			ESE
			L	T	P	CT 1	CT 2	TOTAL	70
Subject:	Open Elective -2X		3	-	-	15	15	30	

Open Elective-2A or Open Elective-2B or Open Elective-2C or Open Elective 2D-	Any one subject to be Selected from the Professional Electives

Open Elective-2 (OE Group-2)	
CE07TOE02A	Artificial Neural Network
CE07TOE02B	Economic Policies in India
CE07TOE02C	History of Science and Engineering
CE07TOE02D	Cyber Law and Ethics

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TOE02A	3	0	0	15	15	30	70	100	3
Subject:	Artificial Neural Network									

Course Learning Objectives:

- To provide an introduction to the field of artificial neural networks
- To Study Basic learning algorithms: the back propagation algorithm, self-organization learning etc.
- Model a Neuron and Express both Artificial Intelligence and Neural Network
- To promote further independent learning on the topics of artificial neural networks
- To learn Supervised and unsupervised Learning and Self-organization Feature Map.

Course Content:

UNIT-1 Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction, and Gradient Descent Rule Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.

UNIT–2 Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, µ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.

UNIT-3 Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.

UNIT- 4 Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

UNIT- 5 Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

Text Books:
1. .E.Rich and K.Knight ,Artificial Intelligence ,Forty Sixth Edition Tata McGrawHill,2007
2. D.W. Patterson,Introduction to Artificial Intelligence and Expert Systems, Tenth Edition ,Prentice Hall of India,2001
3. Klaus Obermayer and Terrence J. Sejnowski, Self-Organizing Map Formation, October 2001
4. Daniel J. Amit , Modeling Brain Function, 1989, Cambridge University Press.

Course Outcomes- The students would have learnt:

CO1: Model Neuron and Neural Network, and to analyse ANN learning, and its applications.
CO2:Able to solve the problem of Supervised Learning.
CO3: can able to apply SVM for image classification .
CO4: Evaluate a practical solution obtained using neural networks.
CO5: Can able to use Self-organization Feature Map.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Artificial Neural Network (CE07TOE02A)

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

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

\

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TOE02B	3	0	0	15	15	30	70	100	3
Subject:	Economic Policies in India									

Course Learning Objectives: The course seeks to equip students with sector-specific knowledge and skills to analyze key economic issues and policy documents. It will also enable them to relate theoretical frameworks of macroeconomics and microeconomics to the Indian context.

Course Content:

UNIT-1 Macroeconomic policies and their impact: fiscal policy; financial and monetary policies.
UNIT–2Agriculture: policies and performance; production and productivity; credit; labor markets and pricing; land reforms; regional variations.
UNIT-3 Industry: policies and performance; production trends; small scale industries; public sector; foreign investment, labor regulation
UNIT- 4 Services and trade: trends and performance, trade and investment policy
UNIT- 5 Indian development experience: a critical evaluation of growth, inequality, poverty and competitiveness, pre-and post-reform eras
Text Books:
1. Dutt Rudder and K.P.M Sunderam (2001): Indian Economy, S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2001) "Indian Economy and –Its development experience", Himalaya Publishing House.
3. KapilaUma: Indian Economy: Policies and Performances, Academic Foundation
4. Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.

Course Outcomes-
Students will have the capability to understand government policies and will enable informed participation in economic decision making, thus improving their employment prospects and career advancement.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Economic Policies in India (CE07TOE02B) [NOT TAUGHT BY CIVIL ENGG. DEPARTMENT]

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE07TOE02C	3	0	0	15	15	30	70	100	3
Subject:	History of Science and Engineering									

Course Learning Objectives:

Course Content:

UNIT-1Historical Perspective
The nature of science and technology, Roots of science and technology in India, Science and society, Scientists and society, Science and Faith and the rise of applied sciences.
UNIT–2Policies and Plans after Independence
Nehru's vision of science for independent independent India, Science and technology developments in the new era science and technology developments during the Five Year Plan Periods and science and technology policy resolutions.
UNIT-3 Research and Development (R&D) in India
Expenditure in R&D, Science and Technology Education, Research activities and promotion of technology development, Technology mission, Programs aimed at technological self-reliance, activities of council of scientific and industrial research (CSIR).
UNIT- 4 Science and Technological Developments in Major Areas
Space – Objectives of space programs, Geostationary Satellite Services – INSAT system and INSAT services remote sensing applications, Launch Vehicle TechnologyOcean Development – Objectives of ocean development, Biological and mineral resources, Marine research and capacity building Defence Research – Spin-off technologies for civilian use, Biotechnology – Applications of biotechnology in medicine, Biocatalysts, Agriculture, Food, Fuel and Fodder, Development of biosensors and animal husbandryEnergy – Research and development in conservation of energy, India's nuclear energy program, technology spin-offs.
UNIT- 5Nexus between Technology Transfer and Development
Transfer of Technology – Types, Methods, Mechanisms, Process, Channels and Techniques, Appropriate technology, Technology assessment, Technological forecasting, Technological innovations and barriers of technological change.

Text Books:
1. Kalpana Rajaram, Science and Technology in India, Published and Distributed by Spectrum Books (P) Ltd., New Delhi – 58.
2. Srinivasan, M., Management of Science and Technology (Problems & Prospects), East-West Press (P) Ltd., New Delhi.
3. Ramasamy, K.A., and Seshagiri Rao, K., (Eds), Science, Technology and education for Development, K., Nayudamma Memorial Science Foundation, Chennai – 8.
4. Kohili, G.R., The Role and Impact of Science and Technology in the Development of India, Surjeet Publications.
5. Government of India, Five Year Plans, Planning Commission, New Delhi.
6. Sharma K.D., and Quresh M.A., Science, Technology and Development, Sterling Publications (P) Ltd., New Delhi.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: History of Science and Engineering (CE07TOE02C) [NOT TAUGHT BY CIVIL ENGG. DEPARTMENT]

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	3
Subject Code:	CE07TOE02D									
Subject:	Cyber Law and Ethics	3	0	0	15	15	30			

Course Learning Objectives:

1. To Create cyber security awareness and to understand principles of web security.
2. To make attentive to students about possible hacking and threats in this communication era.
3. To understand key terms and concepts in cyber law, cybercrimes, intellectual property, Copyright trademarks and domain theft.
4. To understand the business impact and potential of e-commerce and to learn about the technologies required to make e-Commerce viable.
5. Discuss Issues for creating Security Policy, Jurisdictional Issues and dispute resolution in cyberspace.

Course Content:

UNIT-1
Introduction Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Cyber Law - International Perspectives UN & International Telecommunication Union (ITU) Initiatives Council of Europe - Budapest Convention on Cybercrime, Asia-Pacific Economic Cooperation (APEC), Organization for Economic Co-operation and Development (OECD), World Bank, Commonwealth of Nations.

UNIT–2 Constitutional & Human Rights Issues in Cyberspace Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection, Cyber Crimes & Legal Framework Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud Cyber terrorism, Cyber Defamation.

UNIT-3 Cyber Torts Cyber Defamation, Different Types of Civil Wrongs under the IT Act 2000, Intellectual Property Issues in Cyber Space Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues

UNIT- 4 E-Commerce Concept, E-commerce-Salient Features, Online approaches like B2B, B2C & C2C Online contracts, Click Wrap Contracts, Applicability of Indian Contract Act, 1872,

UNIT- 5 Dispute Resolution in Cyberspace, Concept of Jurisdiction, Indian Context of Jurisdiction and IT Act, 2000. International Law and Jurisdictional Issues in Cyberspace, Dispute Resolutions .

Text Books:
1. Chris Reed & John Angel, Computer Law, OUP, New York.
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi.
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute.
4. Jonthan Rosenoer, Cyber Law, Springer, New York.
5. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.
6. S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd.

Course Outcomes-After successful completion of the course, students

CO1 Will be able to analyse and evaluate the cyber security needs of an organization.

CO2 Will be able to implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.

CO3 Will be able to understanding of the fundamental legal principles relating to confidential information, copyright, patents, designs, trademarks and unfair competition;

CO4 Will be able to apply the skills necessary for large-scale web based e-commerce project development and e-commerce application.

CO5 Design operational and strategic cyber security strategies and policies for dispute resolution in cyberspace.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Cyber Law and Ethics (CE07TOE02D) [NOT TAUGHT BY CIVIL ENGG. DEPARTMENT]

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VII)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
Subject Code:	CE07PPC08	L	T	P	IA	TOTAL	-	50	1.5
Subject:	Seminar	0	0	3	50	50			

SYLLABUS	(SEMESTER-VII)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
Subject Code:	CE07PPC09	L	T	P	IA	TOTAL	40	100	3
Subject:	Minor project	0	0	6	60	50			

SYLLABUS	(SEMESTER-VII)	Periods/ Week			Internal Assessment (IA)		ESE	Grand Total	Credits
Subject Code:	CE07PPC10	L	T	P	IA	TOTAL	20	50	1.5
		0	0	3	30	30			
Subject:	Estimation and Costing								

Course Objective

1. Impart the knowledge of estimating and costing for civil engineering structures
2. Prepare and Evaluate the

1. Estimation of building (long wall and short wall method)
2. Estimation of building (center line method)
3. Analysis of rate for concrete work
4. Analysis of rate for brick work
5. Analysis of rate for plaster work
6. Estimate quantity of reinforcement
7. Preparation for approximate estimate for road project
8. Estimating cost of building on plinth area method

Course Outcome

CO1 Prepare quantity estimates for buildings, Roads as per specification
CO2 Draft detailed specifications and work out rate analysis for all the works related to civil engineering projects
CO3 Ascertain the quantity of material required for civil engineering work as per specifications
CO4 Prepare cost estimatefor civil engineering work.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Estimation and Costing (CE07PPC10)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	3	2		1			2		1	3	2	1	
CO 2	1	2	3	2		1			2		1	3	2	1	
CO 3	1	2	3	2		1			2		1	3	2	1	
CO 4	1	2	3	2		1			2		1	3	2	1	

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject Code:	CE08TPC18									
Subject:	Earthquake Resistant Design of Structures	3	0	0	15	15	30			

Course Learning Objectives:
i.   To introduce Engineering seismology and functional planning and the effects of configurations of buildings for earthquakes.
ii. To introduce the requirements for conceptual design for earthquake safety and the analysis methods.
iii. To acquaint with IS code-based design lateral forces for earthquake resistant design of structures.
iv. To identify the behavior of structural and nonstructural elements for seismic resistance and impart design of shear walls.
v.   Introduce Capacity Design as per IS 13920: 2016, Capacity Design for Beams, Columns, beam column joints and structure as a whole.

Course Content:

UNIT 1: Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India. Introduction-Functional Planning-Continuous load path- Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements- regular and irregular configurations-basic assumptions.

UNIT 2: Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures. Twisting of Buildings – Flexible Building and Rigid Building Systems. Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete – Masonry, Steel Structures. Design Earthquake Loads – Basic Load Combinations – Permissible Stresses. Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method – Modal Analysis Torsion.

UNIT 3: Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods. RC Buildings – IS Code based Method. - Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear –.

UNIT 4: Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures, Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls.

UNIT 5: Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during earthquakes- Vulnerability of open ground storey and short columns during earthquake- Seismic Evaluation and Retrofitting. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

Text Books/References:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd

3. Earthquake Resistant Design for Engineers & Architects by Dowrick, D. J., John Willey & Sons, 2nd Edition; 1987.
4. Earthquake Resistant Design of structures by S. K. Duggal, Oxford University Press.
5. Concrete Structures in Earthquake Regions by Booth, E., Longman Higher Education, 1994.
6. Reinforced Concrete Structures by Park, R. &Paulay, T., John Willey & Sons, 2nd Edition; 1975.
7. Masonry and Timber structures including earthquake Resistant Design –Anand S.Arya, Nem chand & Bros.
8. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial College Press.
9. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
10. Dynamics of Structures by A.K.Chopra, Second edition (2001), Prentice Hall India Private Ltd
11. Handbook on Seismic Analysis and Design of Structures by Farzad Naeim, Kluwer Academic Publisher, 2001.

Reference Codes:

1. IS 1893 (Part-1): 2016, "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
2. IS 4326: 2013, "Earthquake Resistant Design and Construction of Building", Code of Practice, B.I.S., New Delhi.
3. IS 13920: 2016, "Ductile design and detailing of reinforced concrete structures subjected to seismic forces" – Code of practice, B.I.S., New Delhi.

Course Outcomes:
On the completion of this course, the student will be able to:
a. Identify the causes of earthquakes, its propagation, and measurement and can quantify the hazard at the location of the structure and quantify the forces based on the source.
b. Adopt a suitable structural system to resist earthquake forces considering safe behavior of structural and nonstructural elements with different material properties and load combinations.
c. Design seismically safe structures in accordance with the provisions of Indian code IS 1893.
d. Implement design of shear wall elements for earthquake safety of structures.
e. Design or retrofitting of structures by detailing the elements, beams, columns, beam-column joints as per capacity-based design adopting ductility provisions as per IS 1893, IS 13920, to mitigate the vulnerability of earthquake damages of elements and structures.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Earthquake Resistant Design of Structures (CE08TPC18)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	1							1	3	2	
CO2	3	3	3	2	1							1	3	2	
CO3	3	3	3	2	1							1	3	2	
CO4	3	3	3	2	1							1	3	2	
CO5	3	3	3	2	1							1	3	2	

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)						
Subject Code:	CE08TPE06	CREDITS: 3			SESSIONAL - TA		ESE
Subject:	Professional Elective -6	L	T	P	CT-I	CT-II	TOTAL
		3	-	-	15	15	30	70

Professional Elective-6A or Professional Elective-6B or Professional Elective-6C or Professional Elective-6D or Professional Elective-6E	Any one subject to be Selected from the Professional Electives Group-6
Professional Electives Group -6	
CE08TPE01A	Offshore Engineering
CE08TPE01B	Surface Hydrology
CE08TPE01C	Bridge Engineering
CE08TPE01D	Water and Air Quality Modelling
CE08TPE01E	Construction Equipment & Automation

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TPE01A	3	0	0	15	15	30	70	100	03
Subject:	Offshore Engineering									

Course Objective:
- To introduce basics of offshore structures and its historical development.
- To characterize static and dynamic loads coming on offshore structure.
- To study about general layout consideration of deck and oil & gas processing system.
- To understand method involving platform installation.
- To learn about material used in design and construction of offshore structure.

Course Content:

UNIT I HISTORICAL DEVELOPMENT OF OFFSHORE STRUCTURES: Introduction – Definition of Offshore Structures – Historical Developments – Deep water challenges, Functions of Offshore Structures, selection of Offshore Structure and its Configurations, Bottom Supported Fixed Structures, Complaint Structures, Floating Structures – Novel offshore design – Field development concepts

UNIT 2 LOAD AND RESPONSES: Introduction, Gravity Load, Hydrostatic Loads, Resistance Loads, Current loads on Structures, Current Drag and Lift Force, Steady and Dynamic Wind Loads on Structures, Wave Loads on Structures, Varying Wind Load, Impulse loads and Introduction to design

UNIT 3TOPSIDE FACILITIES AND LAYOUT: Introduction - General layout Considerations - Areas and Equipment - Deck Impact Loads - Deck Placement and Configuration - Float over Deck Installation - Helipad - Platform Crane - Living quarters - Oil and gas treatment - Oil and gas storage, offloading and export - Utility and process support systems - Drilling facilities

UNIT 4 OFFSHORE INSTALLATION: Introduction – Installation of Fixed Platform Substructures - Floating Structures – Foundations - Subsea Templates – load outs - transportation - Platform Installation Methods and installation criteria – Installation of Pipelines and Risers.

UNIT 5: MATERIALS FOR OFFSHORE APPLICATIONS: Material for Construction-Structural Steel, Topside Materials, Advanced Composite materials, Corrosion Control, Material Reliability and Monitoring and Fracture Control.

Textbooks:
1. Dawson, T.H., "Offshore Structural Engineering", Prentice Hall, 1983
2. B.C Gerwick, Jr. "Construction of Marine and Offshore Structures", CRC Press, Florida, 2000.
3. Subrata K Ckakrabarti, "Handbook of Offshore Engineering", Vol 1, Vol 2, Elsevier Publishers, 1 st edition, 2005.

Reference Books:
1. API RP 2A., "Planning Designing and Constructing Fixed Offshore Platforms", API
2. McClelland, B &Reifel, M.D., "Planning & Design of fixed Offshore Platforms", VanNostrand, 1986
3. Graff, W.J., "Introduction to Offshore Structures", Gulf Publ. Co. 1981.
4. Reddy, D.V &Arockiasamy, M., "Offshore Structure" Vol.1 & 2,

Course Outcomes:

CO1: To classify types of offshore structure and know its basic fundamental knowledge.
CO2: To analyze various loads and their response on the structure.
CO3: To describe process involving deck layout and oil & gas treatment.
CO4: To outline key feature of platform, foundation and pipelines installation.
CO5: To identify and select appropriate material for construction.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Offshore Engineering (CE08TPE01A)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1			2	2						3		
CO2	3	2	1	2	2	2	2						3	2	1
CO3	2	2	2	2	2	1	1						3	1	2
CO4	2	2	2	2	2	1	1						3	1	2
CO5	2	2	2	2	1	3	3						3		2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TPE01D	3	0	0	15	15	30	70	100	03
Subject:	Water and Air Quality Modelling									

Course Objectives:
•Understand the idea, methodology and basic tools of water and air quality modelling
• Understand the different modelling approaches, their scope and limitations.
• Understand the fate and transport of pollutants in different water bodies and ambient air.
• Become mindful of a wide range of applications of modelling for the water quality and air pollution.
• Understand Water quality indexing parameters and its application.

COURSE CONTENT:
UNIT I MODELING CONCEPTS: Casual and statistical models-Characteristics- Steps in model development - Importance of model building. - conservation of mass and mass balance – calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles.

UNIT II WATER QUALITY MODELING: Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods.

UNIT III AIR POLLUTION MODELING: Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution –Transport of air Pollutants - Meteorological settling for dispersal of air pollutants – Vertical structure of temperature and stability, atmospheric motions, Wind and shear, self-cleaning of atmosphere; transport and diffusion of stack emissions – atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.

UNIT IV AIR QUALITY MODELS: Types of modeling technique, modeling for non-reactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models- diffusion models – Gaussian plume derivation- modifications of Gaussian plume equation- long term average-multiple cell model- receptor oriented and source-oriented air pollution model performance, accuracy and utilization.

UNIT V Water Quality Index: Categories of water quality index. Determination of water quality index (WQI): Industrial and municipal effluent index, ambient water quality index, combined water quality index and Delphi method. Air Quality Index: Categories of air quality index. Determination of air quality index (AQI): National AQI, Extreme value indices, regional indices.

Reference Books:
1. Arthur C. Stern, Air Pollution, Air Pollutants, their transformation and Transport, (Ed.), (Third Ed.) Volume I , Academic Press, 2006.
2. Chapra, S.C. Surface Water-Quality Modelling, McGraw-Hill, International Edition, 2008
3. Deaton and Wine Brake, Dynamic Modeling of Environmental Systems, Wiley & Sons, 2002
4. E.V. Thomson, Principles of Surface Water Quality Modeling and Control, Happer and Row Publishers New York, 1987.
5. Hadlock, C.R., Mathematical Modelling in the Environment. The Mathematical Association of America.
6. J.L. Schnoor, Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil, John Wiley & Sons Inc., New York, 1996.
7. Lohani B. N. and North A. M. Environmental Quality Management, South Asian Publishers Pvt. Ltd., New Delhi, 1984.

8. Rastogi A.K. (2008) Numerical Groundwater Hydrology, Penram International Publishing Pvt. Ltd., Bombay.
9. Steven C. Chapra, Surface Water Quality Modeling, Tata McGraw-Hill Companies, Inc., New Delhi, 1997.
10. Thomann, R.V. and Mueller, J.A. (1987). Principles of Surface Water Quality Modelling and Control, Harper &
11. Wainwright, J and Mulligan, M., Environmental Modelling Finding simplicity in complexity, John Wiley and Sons Inc., New York, 2013.

Course outcomes:

CO1: To provide basic knowledge on mathematical and statistical concepts required for mode   development.

CO2: To Develop models based on the mass-balance approach

CO3: To Perform data exploration and visualization

CO4: To Predict the impact of the of external waste loading on different water bodies

CO5: To Design and model of air & water quality and its applicability in the Control of pollution

CO6: To Determine and evaluate the water quality index

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Water and Air Quality Modelling (CE08TPE01D)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	1	2	1	2							3	1	1
CO2	3	3	1	2	1	1							2	1	1
CO3	3	2	1	2	1	2							3	1	1
CO4	3	2	1	2	1	2							3	1	1
CO5	3	3	1	2	1	1							3	1	1
CO6	3	2	2	1	1	2							2	1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TPE01E	3	0	0	15	15	30	70	100	03
Subject:	Construction Equipment & Automation									

Course Learning Objectives:
- To understand the factor for equipment selection and cost of owning and operating.
- To expertise in evaluation and analysis of different equipment life.
- To learn the engineering fundamentals of excavating equipments.
- To learn fundamentals of the pile driving and lifting equipments.
- To understand the concreting equipments and techniques and the advanced instruments like GIS etc. In construction.

Course Content:

UNIT 1: Introduction to course & Planning Process of Equipment Factors affecting equipment selection. Cost of Owning and Operating Construction Equipment Elements of ownership cost, Depreciation accounting methods, Cost Estimation using Average Annual Investment method. Use of compounding factors in Equipment cost estimation based on time value method, Operating cost components, Caterpillar method and Peurifoy method.

UNIT 2: Equipment life and replacement analysis determination of economic life of equipment. Minimum cost method, Maximum profit method, Time value concept

UNIT 3: Engineering Fundamentals of Moving Earth Machine Performance-Required power, Available power, Usable power, Performance chart.
Earthmoving and Excavating equipment Bull Dozers, Scrapers, Front end loaders, Excavators, Trucks, Productivity estimation and balancing of interdependent machines

UNIT 4 Piles and Pile driving equipment Pile types, pile hammers, principle of pile hammer, factors affecting pile hammer selection, Types of pile hammer: Drop hammer, Single acting and double acting steam hammers, Diesel hammers, Vibratory pile drivers.
Lifting equipment Cranes, Principles of lifting mechanism of crane, types of cranes-lattice boom crawler crane, lattice boom truck mounted cranes, telescopic boom crane, Tower cranes, Factors affecting lifting capacity of crane, Range diagram.

UNIT 5 Concreting equipment Steps in concrete making process, types of concrete mixer machines, Methods of handling and transporting concrete, Consolidation of concrete, Methods of finishing and curing of concrete. Aerial and Satellite Surveying: GIS and GPS in Construction; use of Drones for spread out sites; Use of robots for repetitive activities.

Reference Books:
1. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi
2. Construction Equipment & Planning and Application. - Mahesh VermaArtec Publication.
3. GPS satellite surveying- Alfred Leick,.Wiley

Course Outcomes- At the end of the course students will be able to:
CO1   To apply the knowledge in equipment selection and able to find cost of owning and operating.
CO2   To find the equipment life, which help in comparisons of different equipments.
CO3   To select the earth excavating equipment on the basis of output and different selection factors.
CO4   To decide the pile driving equipment and lifting equipment based on safe working load determination
CO5   To decide the concreting equipment based on the construction project and relate the knowledge on Surveying to the new frontiers of science like GIS, GPS and Remote Sensing.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Construction Equipment & Automation (CE08TPE01E)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	2	2		1			2		3	3	2	1	
CO2	1	2	2	2		1			2		3	3	2	1	
CO3	2	2	2	2		1			2		3	3	2	1	
CO4	2	2	2	2		1			2		3	3	2	1	
CO5	2	2	2	2	2	1			2		3	3	2	1	

- Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)						
Subject Code:	CE08TPE02X	CREDITS:3			SESSIONAL - TA		ESE
Subject:	Professional Elective -7X	L	T	P	CT-I	CT-II	TOTAL
		3	0	-	15	15	30	70

Professional Elective-7A or Professional Elective-7B or Professional Elective-7C or Professional Elective-7D or Professional Elective-7E	Any one subject to be Selected from the Professional Electives

Professional Electives Group -7	
CE08TPE02A	Infrastructure Planning and Design
CE08TPE02B	Traffic Engineering
CE08TPE02C	Repair and Rehabilitation of Structures
CE08TPE02D	Finite Element Analysis
CE08TPE02E	Urban Hydrology and Hydraulics

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TPE02A							70	100	03
Subject:	Infrastructure Planning and Design	3	0	0	15	15	30			

Course Learning Objectives:
1. To introduce the various infrastructure sector role in India
2. To explain the effect of Infrastructure Privatization with case studies.
3. To introduce the risks in successful infrastructure planning and implementation.
4. To impart the strategies for successful infrastructure project implementation.
5. To explain Innovative Design and Maintenance of Infrastructure Facilities.

Course Content:

UNIT 1: An overview of Basic Concepts Related to Infrastructure: Introduction to Infrastructure, an overview of the Power Sector in India., an Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation Sectors in India., an overview of the Telecommunications Sector in India. , an overview of the Urban Infrastructure in India, an overview of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an overview of Infrastructure Project Finance

UNIT 2: Private Involvement in Infrastructure: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

UNIT 3: Challenges to Successful Infrastructure Planning and Implementation: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks: The Case study for Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

UNIT 4: Strategies for Successful Infrastructure Project Implementation: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects, Sustainable Development of Infrastructure, Information Technology and Systems for Successful Infrastructure Management.

UNIT 5: Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

Text Books/References:

1. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).
2. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).
3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).
4. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment Proceedings of a Conference Held in June (1990).
5. World Development Report 1994: Infrastructure for Development (1994).
6. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest,September (2000).

Course Outcomes:
On the completion of this course, the student will be able to:

CO1   Design an integrated framework for infrastructure planning and management.
CO2   Analyse the strategies for Infrastructure Project implementation.
CO3   Perform Infrastructure modelling and Life Cycle Analysis Techniques.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Infrastructure Planning and Design (CE08TPE02A)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	3	2	3	2				2		2	3	1
CO2	2	3	3	2	2	2	1				2		1	2	1
CO3	3	1	3	3		2							2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TPE02B	3	0	0	15	15	30	70	100	03
Subject:	Traffic Engineering									

Course Objectives:

1. To develop the basic knowledge of Traffic Engineering.
2. To define Traffic flow characteristic.
3. To develop knowledge about traffic control system.
4. To understand the parking and highway lighting
5. To develop the knowledge of different pollution occurring and its remedial measures.

Course Content:

UNIT 1: Introduction To Traffic Engineering-Definition and Scope of Traffic Engineering, Functions, Organization and Importance of Traffic Engineering. Elements of Traffic Engineering: Vehicular, Driver and Road Characteristics.

UNIT 2: Traffic Flow Parameters -Traffic flow parameters: volume, density, speed and related terms, Relationship between various parameters, Study and analysis of vehicle arrivals, headways, and gap acceptance in traffic flow. Highway Capacity and Level of Service.

UNIT 3: Traffic Control-Definition, functions and importance of traffic control. Methods of traffic control: Traffic signs, Road Markings, and other traffic controls aids. Traffic Regulation. Intersection control and design of traffic signals.

UNIT 4: Parking- Parking survey, types of parking, design of parking places. Lighting-Lantern arrangement, Types of lamp

UNIT 5: Traffic and Environment- Pollution problems of cities, Detrimental effects of traffic on environment, Noise pollution, Air pollution, Vibration, Environmental Impact Assessment.

Text Books:
1. Kadialy L.R., "Traffic Engg. and Transport Planning", 8th edition, Khanna Publishers.
2. Partha chakrobarty & Animesh Das, "Principles of Transportation Engineering", PHI.
3. C. Jotin Khisty, B. Kent Lal, "Transportation Engineering – An Introduction", PHI.

Course Outcomes:

   At the end of this course the student will be able to
   CO1   estimate the basic characteristics of traffic stream
   CO2   conduct traffic flow studies and analyze traffic data
   CO3   design traffic signal systems
   CO4   analyse the parking and highway lighting
   CO5   manage controlling the different pollution occurring in road.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Traffic Engineering (CE08TPE02B)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1										3		2
CO2	3	2	2	1									2	3	2
CO3	3	2	3	1									3	2	1
CO4	3	2	2	1									3		2
CO5	3	2				2	3						3		2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE08TPE02C	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	Repair and Rehabilitation of Structures	3	0	0	15	15	30			

Course learning objectives:
- To learn about various distress and damages in concrete and steel structures.
- To learn about assess the damage to structures using various methods.
- To study the various methods of rehabilitation.
- To study the various methods of repairs of structures.
- To learn importance of repair and maintenance of structures.

Course Content:

UNIT 1: Aging of structures – performance of structures – need for rehabilitation. Distress in concrete / steel structures – damage – source – cause – effects – case studies.

UNIT 2: Damage assessment and Evaluation models – Damage testing methods – NDT – Core samples.

UNIT 3: Rehabilitation methods – grouting – detailing – imbalance of structural stability – case studies.

UNIT 4: Methods of repairs – shotcreting – guniting – epoxy – cement mortar injection – crack ceiling.

UNIT 5: Repair and maintenance of buildings – IS standards – Bridge repairs – Seismic strengthening.

Reading/Textbooks:
1. Diagnosis and treatment of Structures in Distress – R N Raikar.
2. Bridge Rehabilitation – V K Raina.
3. Building Failures – Diagnosis and Avoidance – W H Ranson.
4. Forensic Engineering – Kennethe and Carper.

Course outcomes:
  Upon completion of this course students will be able to:
- Analyze distress and damages in concrete and steel structures.
- Understand about assess the damage to structures using various methods.
- Classify the various methods of rehabilitation.
- Classify the various methods of repairs of structures.
- Understand the importance of repair and maintenance of structures.

  Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Repair and Rehabilitation of Structures (CE08TPE02C)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	1	1							3	2	2
CO2	3	3	2	1									2	2	2
CO3	3	3	2	2		1							2	2	1
CO4	3	3	2										2	2	1
CO5	3	3	3			1							2	2	1

- Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TPE02D	3	0	0	15	15	30	70	100	03
Subject:	Finite Element Analysis									

Course Objectives:
 1. To learn basic principles of finite element analysis procedure.
 2. To learn the theory and characteristics of finite elements that represent engineering structures.
 3. To learn and apply finite element solutions to structural and dynamic problem to develop the   knowledge and skills needed to effectively evaluate finite element analyses

Course Content:

UNIT 1: Matrix Methods of Structural Analysis – Review of concepts – Actions and displacements – compatibility – indeterminacy – Member and joint loads – Flexibility Matrix formulation - Stiffness Matrix formulation.

UNIT 2: Analysis of Beams- Finite Element formulation and Analysis of beams by Finite Element method.

UNIT 3:Analysis of Rigid Jointed Plane Frame- Finite Element formulation and Analysis of rigid jointed plane frame by Finite Element method.

UNIT 4: Analysis of Pin Jointed Plane Frame- Finite Element formulation and Analysis of pin jointed plane frame by Finite Element method.

UNIT 5: Introduction to Plate and Shell Elements- Analysis of plane stress / strain and ax symmetric solids- triangular, quadrilateral and isoperimetric elements, Analysis of plate bending, basic equations of thin plate theory, Reissinner-Mindlin theory, plate elements and applications. Analysis of shells, degenerated shell elements.

Text Books:
1. Chandrupatla T.R., Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Private Limited, New Delhi.
2. Desai C.S., Abel J.F., Introduction to the Finite Element Method, CBS Publishers & Distributors, Delhi.

Reference Books:
1. Krishnamurthy, C.S., Finite Element Analysis – Theory and Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Finite Element Analysis – Theory and Programming by Cook R.D. et.al., Concepts and Applications of Finite Element Analysis, John Wile

Course outcomes:
Upon successful completion of this course, you should be able to:
 1. Understand the concepts behind formulation methods in FEM.
2. Identify the application and characteristics of FEA elements such as bars, beams, plane.
3. Analyze the rigid and pin jointed plane frame using finite element method.
4. Understand the concept of isoparaemtric elements and its applications to plane stress and plane strain problems

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Finite Element Analysis (CE08TPE02D)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	1		1							1			
CO 2	2	1	1									1	1		
CO 3	3	3	2	2	1							3	3	3	
CO 4	3	3	2	2	1							3	3	3	

- Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TPE02E	3	0	0	15	15	30	70	100	03
Subject:	Urban Hydrology and Hydraulics									

Course Objectives:
1. To describe physical properties of urban area.
2. To understand the elements of drainage systems.
3. To study about urban water supply
4. To know about the measures to control storm water pollution
5. To learn urban watershed software.

Course Content:

UNIT 1: Urbanisation: Process of urbanisation, Trends of urbanisation and industrialisation, influence on hydrologic cycle, effects and consequences for drainage, Rainfall analysis in urban environment, design storm. Urban Runoff computations: Empirical, Time-area and unit hydrograph approaches. Urban storm water runoff: overland flow.

UNIT 2: Design of drainage system elements: Hydraulic fundamentals, infiltration and on-site detention of storm water, design of sewerage and drainage channels, design of appurtenances, road drainage, design of pumping stations

UNIT 3: Urban water supply: Estimate of demand, sources in surface and groundwater, Reservoir, capacity estimation.

UNIT 4: Control of storm water pollution: Pollution build-up and wash off process with reference to urban drainage systems. Source control in commercial and industrial complexes, storage options - dry and wet ponds, biological treatment of wastewater, chemical treatment of storm water

UNIT 5: Introduction to urban watershed software - Hydrologic Cistern, water conservation and ecological aspects, Water harvesting.

TEXT BOOKS:
1. Chow V T, Handbook of Applied Hydrology: A Compendium of Water resources technology, McGraw Hill, New York, 1964.
2. Gupta R S, Hydrology and Hydraulic Systems, Prentice Hall Publishers, New Jersey, 1989.
3. Geiger W F, Marsalek J Z, and Rawls G J, Manual on Drainage in Urban Areas, 2 Volumes, UNESCO, Paris, 1987
4. Hall M J, Urban Hydrology, Elsevier Applied Science Publishers, New York, 1984.
5. Stahre P, and Urbonas B, Stormwater Detention for Drainage, water quality and CSO Management, Prentice Hall Publishers, New Jersey, 1983.
6. Wanielista M P, and Yousef Y A, Stormwater Management, JohnWiley and Sons, New York, 1993.

Course Outcome: At the end of the course students shall be able to:
1. Understand and explain the effects of urbanization on rainfall and runoff.
2. Design various urban drainage system elements.
3. Estimate the demand of urban areas
4. Identify and apply the control required for storm water pollution
5. Use urban watershed software for simulation purpose.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Urban Hydrology and Hydraulics (CE08TPE02E)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	2							3	2	2
CO2	3	3	2	3	3	3							3	2	2
CO3	3	3	3	3	3	2							3	2	3
CO4	3	3	3	2	3	2							3	2	2
CO5	3	2	3	3	3	2							3	3	3

- Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)						
Subject Code:	CE08TOE01X	CREDITS: 3			SESSIONAL - TA		
Subject:	Open Elective - 3X	L	T	P	CT-I	CT-II	TOTAL
		3	-	-	15	15	30

Open Elective-3A or Open Elective-3B or Open Elective-3C or Open Elective-3D	Any one subject to be Selected from the Open Electives Group 3

Open Electives Group 3	
CE08TOE01A	Management Information System
CE08TOE01B	Enterprise Resource Planning
CE08TOE01C	Engineering Risk-Benefit Analysis
CE08TOE01D	Human Resources Development and Organizational Behaviour

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE08TOE01A	L	T	P	CT-1	CT-II	TOTAL			
Subject:	Management Information System	3	0	0	15	15	30	70	100	03

Course objectives:
- To study about the role of management information technology in organizations.
- To study about the fundamental principles of computer-based information system analysis.
- To learn about the design and develop an understanding of the principles and techniques used.
- To study about concept of data moulding and data flow diagrams of information system.
- To learn about the fundamental principles and concept of decision-making process and security system.

Course Content:

UNIT 1: Management and System- Advance in management, the process of MIS development, MIAS organization, Information dynamics.
UNIT 2: Planning, Design and implementation of MIS, Strategic planning, MIS design- Group design concepts, Acquiring information system.
UNIT 3: System life cycle-Information flow, Entity relationship modelling, data modelling, detailed process analysis, data flow diagrams.
UNIT 4: Decision making system with MIS, System concepts for MIS.
UNIT 5: Data information and communication, problem solving and decision making, security, control and failure, Future trends in MIS.

TEXT BOOKS:

1. Management Information Systems, by S. Sadagopan, PHI Learning Pvt. Ltd
Management Information Systems By. Chatterjee, PHI Learning Pvt. Ltd
Management Information Systems (11th Edition), by Ken Laudon and Jane Laudon

Course Outcomes:
At the end of the course the students shall be able
CO1   To understand the role of management information technology in organizations.
CO2   To understand the fundamental principles of computer-based information system analysis.
CO3   To design and develop an understanding of the principles and techniques used.
CO4   To understand the concept of data moulding and data flow diagrams of information system.
CO5   To understand the fundamental principles and concept of decision-making process and security system.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Management Information System (CE08TOE01A)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1					1			1			1		
CO2	2	1					1								
CO3	2	1	1				1			1					
CO4	2	1								1					
CO5	1	1	1										1		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TOE01B							70	100	03
Subject:	Enterprise Resource Planning	3	0	0	15	15	30			

Course objectives:
1. To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
2. To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
3. To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
4. To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills

Course Content:

UNIT 1: Conceptual foundation of Business Process reengineering: Role of information Technology and BPR; Process improvement and Process redesign, Process identification and mapping; Role/Activity diagrams, Process Visioning, and benchmarking.

UNIT 2: Enterprise Resource Planning: Evolution of ERP- MRP and MRP II, structure of ERP- two tier architecture, three tier architectures, electronic data processing, management information system, Executive information system, ERP as an integrator of information needs at various Levels.

UNIT 3: Typical Business Processes: Core processes, Product control, Sales order processing, Purchases, Administrative processes, Human resource, Finance support processes, Marketing, Strategic planning, Research and development, Problems in traditional view.

UNIT 4: ERP models/functionality: Sales order processing, Production scheduling, forecasting, distribution, finance, features of each of the models, description of data flow across each module, overview of supporting databases & packages.

UNIT 5: ERP implementation issues: Opportunities and problems in ERP selection, and implementation; ERP implementation: identifying ERP benefits, team formation, Consultant intervention, Selection of ERP, Process of ERP.

TEXT BOOKS:
1. V.K. GARG & N.K. VENKATKRISHNAN: ERP, Concepts and Practices, PM
2. Rahul V. Altekar, Enterprise-wide Resource Planning-theory and practice, PHI
REFERENCES:
ALEXIS LEON: Enterprise Resource Planning, TMH S. SADAGOPAN: MIS,
PMV. RAJARAMAN: Analysis and Design of Information Systems, PHIMONK' & BRADY: Concepts in ERP, Vikas pub, Thomson

Course outcomes:
After completing this course, student will be able to
  CO1 Make basic use of Enterprise software, and its role in integrating business functions
  CO2 Analyze the strategic options for ERP identification and adoption.
  CO3 Design the ERP implementation strategies.
  CO4 Create reengineered business processes for successful ERP implementation.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Enterprise Resource Planning (CE08TOE01B) [NOT TAUGHT BY CIVIL ENGG. DEPARTMENT]

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08TOE01C	3	0	0	15	15	30	70	100	03
Subject:	Engineering Risk-Benefit Analysis									

Course Learning Objectives:
1. Understand the basic concepts of risk analysis and the relationship between probability theory and modeling, risk analysis, and decision analysis
2. Understand how to interpret probability and probabilistic modeling, in the evaluation of risk
3. Learn how to understand and interpret the basic tools of risk analysis – fault trees, event trees, and simulation models
4. Understand the issues surrounding the use of risk analysis in decision making

Course Content:

UNIT 1: Introduction- Knowledge and Ignorance, Information Uncertainty in Engineering Systems, Introduction and overview of class; definition of Engineering risk; overview of Engineering risk analysis. Risk Methods: Risk Terminology, Risk Assessment, Risk Management and Control, Risk Acceptance, Risk Communication, Identifying and structuring the Engineering risk problem; developing a deterministic or parametric model

UNIT 2: System Definition and Structure: System Definition Models, Hierarchical definitions of Systems, System Complexity. Reliability Assessment: Analytical Reliability Assessment, Empirical Reliability Analysis Using Life Data, Reliability Analysis of Systems

UNIT 3: Consequence Assessment-Types, Cause-Consequence Diagrams, Microeconomic Modelling, Value of Human Life, Flood Damages, and Consequence Propagation. Engineering Economics: Time Value of Money, Interest Models, Equivalence

UNIT 4: Decision Analysis: Risk Aversion, Risk Homeostasis, Influence Diagrams and Decision Trees, Discounting Procedures, Decision Criteria, Tradeoff Analysis, Repair and Maintenance Issues, Maintainability Analysis, Repair Analysis, Warranty Analysis, Insurance Models

UNIT 5: Data Needs for Risk Studies: Elicitation Methods of Expert Opinions, Guidance

Text Books:

1. Risk Analysis in Engineering and Economics, B. M. Ayyub, Chapman-Hall/CRC Press, 2003.

Reference Books:

1. Probability, Statistics, and Reliability for Engineers and Scientists, Ayyub & Mc Cuen, 2003.
2. Probabilistic Risk Assessment and Management for Engineers and Scientists, by H. Kumamoto and E. J. Henley, Second Edition, IEEE Press, NY, 1996.
3. Bedford, T. and Cooke, R. Probabilistic Risk Analysis: Foundations and Methods. New York: Cambridge University Press, 2001.
4. Normal Accidents, Living with High-Risk Technologies, C. Perrow, Princeton University Press, 1999.
5. Accident Precursor Analysis and Management - Reducing Technological Risk Through Diligence, National Academy of Engineering, the National Academies Press, Washington, DC, 2004.

Course Outcomes:
On the completion of this course, the student will be able to:
    CO1:Understand and apply engineering risk analysis in several fields.

    CO2:Evaluate the Reliability Analysis of Systems.

    CO3:Formulate a decision analysis for models and systems

    CO4:Propose the data requirements for risk analysis in simulation models.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Engineering Risk-Benefit Analysis (CE08TOE01C)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	1		3		3						2	2	
CO2	3	3	1		3		3						2	2	
CO3	3	3	2	1	3		3						2	2	
CO4	3	3	2	1	3		3						2	2	

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE08TOE01D	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	Human Resources Development and Organizational Behaviour	3	0	0	15	15	30			

Course Content:

UNIT 1: HRD-Macro Perspective: HRD Concept, Origin and Need, HRD as a Total System; Approaches to HRD; Human Development and HRD; HRD at Macro and Micro Climate.

UNIT 2: HRD–Micro Perspective: Areas of HRD; HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning, OD or Systems Development, Rewards, Employee Welfare and Quality of Work Life and Human Resource Information; Staffing for HRD: Roles of HR Developer; Physical and Financial Resources for HRD; HR Accounting; HRD Audit, Strategic HRD

UNIT 3: Instructional Technology for HRD: Learning and HRD; Models and Curriculum; Principles of Learning; Group and Individual Learning; Transactional Analysis; Assessment Centre; Behaviour Modeling and Self-Directed Learning; Evaluating the HRD

UNIT 4: Human Resource Training and Development: Concept and Importance; Assessing Training Needs; Designing and Evaluating T&D Programmes; Role, Responsibilities and challenges to Training Managers.

UNIT 5: Training Methods: Training with in Industry (TWI): On the Job & Off the Job Training; Management Development: Lecture Method; Role Play; In-basket Exercise; Simulation; Vestibule Training; Management Games; Case Study; Programmed Instruction; Team Development; Sensitivity Training; Globalization challenges and Strategies of Training Program, Review on T&D Programmes in India.

Reference Books:

1. Nadler, Leonard: Corporat Human Resource Development, Van Nostrand Reinhold, ASTD, New York.
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi, 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi, 2004.
 4. Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi. 5. Rao, T.V. (et.al): HRD in the New Economic Environment, Tata McGraw-Hill Pub.Pvt, Ltd., New Delhi, 2003.
6. Rao, T.V: HRD Audit, Sage Publications, New Delhi.
7. ILO, Teaching and Training Methods for Management Development Hand Book, McGraw-Hill , New York .
8. Rao, T.V: Human Resource Development, Sage Publications, New Delhi. 9. Kapur, Sashi: Human Resource Development and Training in Practice, Beacon Books, New Delhi.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Human Resources Development and Organizational Behavior (CE08TOE01D) [NOT TAUGHT BY CIVIL ENGG. DEPARTMENT]

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE08PPC11	L	T	P	CT-1	CT-II	TOTAL	80	200	07
Subject:	Major Project	0	0	14	-	-	120			

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE08PPC12	0	0	3	-	-	30	20	50	1.5
Subject:	Structural Detailing Lab									

Course Learning Objective:
- To learn detailing of structural steel members (tension & compression member, steel connection)
- To study in detail and draw components of industrial building.
- To understand reinforcement detailing of RCC beams and column footings.
- To know about distribution of reinforcement in slab, stair case, water tank and retaining wall.

Course Content:
Part A: (Steel Structures)
1. Detailing of Tension Members.
2. Detailing of Built-up Compression Members.
3. Detailing of Column Bases.
4. Detailing of connections.
5. Detailing of an Industrial shed.
6. Detailing of a Plate girder/Gantry girder.
Part B: (Reinforced Concrete Structures)
1.Details of reinforcement in RCC Continuous Beams.
2. Details of reinforcement for RCC column with isolated footings.
3. Details of reinforcement in a one way/two-way slabs.
4. Details of reinforcement in stair cases.
5. Detailing of Combined footings.
6. Detailing of Retaining walls/Water Tanks.

Course Outcome:
CO1 To sketch detailed drawing of structural steel beams, columns and connections.
CO2 To understand design components of industrial shed and gantry girder.
CO3 To sketch reinforcement detailing of RCC member as per IS code provision.
CO4 To draw accurate arrangement of reinforcement in slab, stair case, water tank and retaining wall.

Course Outcomes and their mapping with Programme Outcomes and Programme specific outcomes: Structural Detailing Lab (CE08PPC12)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	1									1	2	1	3
CO2	3	2	1									1	2	1	3
CO3	3	2	1									1	2	1	3
CO4	3	2	1									1	2	1	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly