2.3 Final Year B.Tech. Civil Engineering

Sem. VII & VIII

Academic Scheme and Syllabus

Year 2015-16

Scheme for Final Year B.Tech. in Civil Engineering (Semester - VII) Academic Year:2015-16

Sr. No.	Course	Code	Course Plan for Each Week (Hrs)			Credits	Evaluation (Marks)							Total
			Lectures	Laboratory	Tutorial		Test 1	Test 2	End Semester		End Semester Weightage (%)	Practical*	Term Work#	
									Marks	Duration (Hrs)				
1	Limit State Method For Reinforced Concrete Structures	CE401	4	--	2	5	20	20	100	3	60	--	25	125
2	Construction Engineering	CE402	4	--	2	5	20	20	100	3	60	--	25	125
3	Irrigation Engineering	CE403	4	--	2	5	20	20	100	3	60	--	25	125
4	Environmental Engineering-II	CE404	4	2	--	5	20	20	100	3	60	25	25	150
5	Elective - I	CE406 onwards	4	--	2	5	20	20	100	3	60	25	25	150
6	Project-Stage I	CE405	--	--	4	4	--	--	--	--	--	--	50	50
Total			**20**	**2**	**12**	**29**	**100**	**100**	**--**	--	**--**	**50**	**175**	**725**

NOTE: T1 & T2 and end semester weightage marks will be added and shown as the theory marks in the mark sheet. Duration of Test 1, Test 2 is of 1 hour.

* Evaluation based on practical (if possible) / objective type test / Sketching / Mini Project.

\# Distribution of Term Work marks: Journal work = 10 Marks, Attendance =10, Quiz = 05 Marks.

For passing, Student must secure minimum 40% marks in each subject with all heads of passing taken together and minimum 35% marks in the end semester examination

Elective – I

Sr. No.	Code	Elective
1	CE407	Advanced Structural Analysis
2	CE409	Applied Hydrology and Flood Control
5	CE 411	Advanced Surveying
7	CE 413	Systems Approach in Civil Engineering
9	CE 415	Structural Dynamics
11	CE 417	Advanced Foundation Engineering
13	CE419	Pavement Subgrade and Materials
15	CE421	Design of Prestressed Concrete Structures
17	CE 423	Reinforced Concrete Repairs and Maintenance

Sr. No.	Code	Elective
3	CE408	Advanced Computaional Techniques
4	CE410	Solid Waste Mangement
6	CE412	Advanced Repair and Rehabilitation of Structures
8	CE 414	Risk and Value Management
10	CE416	Advanced Structural Mechanics
12	CE418	Ground Water Hydrology
14	CE420	Air Pollution
16	CE422	Traffic Engineering and Control

Scheme for Final Year B.Tech. in Civil Engineering (Semester - VIII) Academic Year:2015-16

Sr. No.	Course	Code	Course Plan for Each Week (Hrs)			Credits	Evaluation (Marks)							Total
			Lectures	Laboratory	Tutorial		Test 1	Test 2	End Semester		End Semester Weightage (%)	Practical *	Term Work#	
									Marks	Duration (Hrs)				
1	Design and Drawing of Reinforced Concrete Structures	CE451	4	--	2	5	20	20	100	4	60	25	25	150
2	Quantity Survey, Estimation and Valuation	CE452	4	--	2	5	20	20	100	4	60	25	25	150
3	Construction Management	CE453	4	--	2	5	20	20	100	3	60	25	25	150
4	Elective-II	CE455 onwards	4	--	2	5	20	20	100	3	60	25	25	150
5	Project –Stage II*	CE454	--	--	4	6	--	--	--	--	--	50**	50##	100
Total			**16**	**--**	**12**	**26**	**80**	**80**	**--**	--	**-**	**150**	**150**	**700**

NOTE T1 & T2 and end semester weightage marks will be added and shown as the theory marks in the mark sheet.Duration of Test 1, Test 2 is of 1 hour.

* Evaluation based on practical (if possible) / objective type test / Sketching / Mini Project.

\# Distribution of Term Work marks: Journal work = 10Marks, Attendance= 10 marks, Quiz =05 Marks.

** Presentation and Viva Voce

Report

For passing, Student must secure minimum 40% marks in each subject with all heads of passing taken together and minimum 35% marks in the end semester examination

Elective – II

Sr. No.	Code	Elective
1.	CE456	Industrial Waste Treatement
2	CE458	Pavement Design and Constriction
5	CE 460	Advanced Engineering Geology
7	CE 462	Geographic Information System
9	CE 464	Appraisal and Implementation of Infrastructure Projects
11	CE 466	Advanced Design of Steel Structures
13	CE 468	Building Services
15	CE 470	Transportation Planning and Economics

Sr. No.	Code	Elective
3	CE457	Earthquake Engineering
4	CE459	Water Resources Engineering and Mangement
6	CE 461	Rock Mechanics
8	CE 463	Environmental Impact Assessment & Audit
10	CE 465	Risk & Disaster Management
12	CE 467	Soil Dynamics
14	CE 469	Design of Hydraulic Structures
16	CE 471	Advanced Construction Engineering

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE401	**Course:- Limit State Method for Reinforced Concrete Structures**		
Prerequisites	**CE356**		
Peiods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20x2
	End semester*	03	100
	Practical	-	-
	Oral	-	-
	Term Work	-	25
	Total		**125**

*60% Weightage for end semester

Course Objectives	• To develop Civil Engineering graduates having clear understanding of concepts of reinforced concrete design using Limit state approach. • Application of LSM to design different RCC members. • To familiarize students to use of IS 456 and relevant IS codes, its importance in RCC design. • To deal with environmental and economic issues.
Course Outcomes	After completing the course student will be able to • Deign RCC members like beam, slab, column, footings using LSM method for safety stability and economy. • Use IS 456 for design of RCC members.

Course Content

Module No	**Topics**	**No of Lectures**
1	Ultimate Load Method: Brief introduction to fundamentals of ultimate strength theory: curved stress distribution, compressive stress block, simplified rectangular stress block as per Whitney's approach, ultimate moment of resistance of singly reinforced section and doubly reinforced sections.	05
2	Limit State Method: Introduction to limit state method of design as per IS 456 (latest edition): concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to various limit states.	04
3	Limit State of Collapse - Flexure: Limit state of collapse in flexure, shear and Limit state of serviceability in deflection and cracking, design of singly reinforced rectangular sections.	06
4	Design and analysis of doubly reinforced rectangular sections, T sections for flexure, design of members in shear and bond, design of beam subjected to bending and torsion. Requirements governing reinforcement detailing.	10
5	Design of Slabs: Design of one way slab, two way slab and flat slabs	05

6	Limit State of Collapse - Compression: Limit state of collapse compression for short and slender column. Column Members subjected to combined axial and uni-axial as well as biaxial bending. Development of interactive curves and their use in column design.	08
7	Design of Foundations: Isolated square and rectangular footings subjected to axial load and moments. Design of combined rectangular pad footings, slab beam type footing and strap footing	10

Term work:-

Assignments consisting of minimum twenty problems covering entire syllabus shall be submitted as term work.

Text Books:-

1. P. Dayaratnam,(2011), "Design of Reinforced Concrete Structures", Oxford &Ibh-Pubs Company-New Delhi, ISBN 8120414195
2. Ashok K. Jain(1993), "Reinforced Concrete: Limit State Design" , Nem Chand & Brothers, ISBN 8185240531, 844 pages
3. Dr. S.R. Karve & Dr. V.L. Shah (1994), "Limit State Theory and Design of Reinforced Concrete", Structures Publishers, ASIN B007I29ARC, 1140 pages
4. V. Ramakrishnan & P.D. Arthur (1969), "Ultimate Strength Design for Structural Concrete", Pitman, ISBN 0273403230, 264 pages
5. Dr. H. J .Shah,(2008),"Reinforced Concrete, Volume 2", Charotar Publishing House Pvt. Limited, ISBN 8185594732, 536 pages
6. S N Sinha, (2002),"Reinforced Concrete Design, Second Revised Edition", Tata McGraw-Hill Education, ISBN 0070473323, 708 pages
7. Karve & Shah, (2011), "Illustrated Design of Reinforced concrete Buildings", mihail-koprivchin-3758, 319 pages
8. P.C. Varghese (2009), Limit state design of Reinforved concrete, PHI Learning.
9. B.C. Punmia, Ashokkumar Jain and Arunkumar jain (2007), Limit State Design of Reinforced Conctrete.

Reference Book

1. Wang, C.K., Salmon, C.G., and Pincheira, (2007),"J.A. Reinforced Concrete Design", 7th Ed, John Wiley and Sons, ISBN 0471262862, 948 pages
2. Phil Moss Ferguson, Henry Jacob Cowan, (1981),"Reinforced Concrete Fundamentals, S I Version", John Wiley & Sons Canada, Limited, ISBN 0471051535, 694 pages.
3. B.P. Hughes (1976), "Limit State Theory for Reinforced Concrete Design", Pitman, ISBN 0273010239

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)		**Semester VII**	
CODE: CE402	**Course:-Construction Engineering**		
Prerequisites	**CE302**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20 x 02
	End semester*	03	100
	Practical	-	-
	Laboratory Work (Journal)	-	-
	Term Work	-	25
	Total		**125**

*60% Weightage for end semester

Equipments: Construction is the ultimate objective of a design and it is the machines which make it possible in a fast and economical way.For the successful completion of a project a constructor has to choose the right set of equipments to complete a particular work in the specified time and with involvement of minimum labour. Thus planning, selection and utilization of any construction equipment helps one to analyze the operational problems on the site and to arrive at practical solutions for completing a task.

Techniques: Simply relying on the appropriate use of suitable equipments cannot be replied upon for the successful completion of any construction project. Understanding the correct construction techniques is vital for making optimal use of the equipments used.

Course Objectives:

1. Explain different types of standard and special equipments used in the construction industry
2. Determine owing and operating costs, evaluate maintenance and repair costs
3. Describe various equipments related to earthmoving , drilling and blasting, pile driving, pumping, stone crushing, air compressors, equipment for moving materials
4. Explain the complex processes involved in the construction of tunnels.
5. Summarize various soil stabilization techniques such as sand drains and stone columns, use of geotextiles and chemicals, diaphragm wall, rock anchors and foundation grouting.

Course Outcomes:

At the end of this course, the students will

1. Be able to select the appropriate equipment for various construction activities, determine its optimal use and estimate its efficiency
2. Describe various methods of tunneling in soft soils and in hard rock, choose suitable equipment and explain various factors related to the planning and construction of tunnels
3. Evaluate requirements of a given construction site and propose a suitable ground improvement technique.

Course Content

Module No	Topics	No of Lectures
1	**Construction equipment:** Standard types of equipment, special equipment, cost of owning and operating equipment, depreciation costs, economic life, factors affecting selection of construction equipment, balancing of equipment. Study of equipments with reference to available types and their capacities, operations and factors affecting their performance.	06
2	**Earthmoving and hauling equipment**: tractors and attachments, dozers and rippers, scrapers, shovels, draglines, trenching machines, clamshell, hoes, trucks and wagons, dumpers, dozers, trenching machines, rollers and compactors. Builder's hoists, forklifts, cranes, belt-conveyors, cableways, ropeways	10
3	**Drilling and blasting equipment, Pile driving equipment and Stone crushing equipment** a. Bits, jackhammers, drifters, drills, blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives b. Types, pile driving hammers: single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory pile drivers c. Jaw, gyratory and cone crushers, hammer mills, roll crushers, rod and ball crushers, aggregate screens and screening plants, portable plants	08
4	**Tunneling**: Selection of alignment, methods of tunneling in soft soils and in hard rock, tunnel boring machines, mucking, ventilation of tunnels, dust control, types of tunnel supports, sequence of lining operation.	08
5	**Soil stabilization techniques**: sand drains, stone columns, use of geotextiles and chemicals, diaphragm wall, rock anchors, foundation grouting.	06
6	**Concrete:** mass concreting, vaccum concrete, forms for concrete construction: slip forms, collapsible forms, forms for cantilevers, concrete mixers	08
7	**Different types of cladding**: fixing and maintenance arrangements	02

Term work:-
At least one site visit should be arranged to give an exposure to various construction equipment and techniques discussed in the above syllabus. A report on site visit and at least 10 assignments shall be submitted as term work.

Recommended Books:-

1. Peurifoy, Schexnayder, and Shapira (2013); "Construction Planning, Equipment and Method" McGraw Hill Education (India) Private Limited. ISBN-13 9780070706996.
2. S C Sharma (2002); "Constrution Equipment and Its Management" Khanna Publications. ISBN-13 978-8174091376. 982p.
3. Mahesh Varma (1975); "Constrution Equipment and Its Planning and Management" Metropolitan Book Company. ASIN: B0007AK5JY. 531p
4. C. B. Navalkar (2005); "Textbook on Explosive Engineering – Blasting Technology &

Explosive Applications, Basics, State of the Art & Instrumentation" SEMCONS Consultants. 108p

5. S. Seetharaman (2000); "Construction Engineering & Management", Umesh, S Chand, New Delhi ISBN-13 – 9788188114061. 487p.
6. USBR, Earth Manual
7. USBR, Concrete Manual
8. Bowels J E (1997); "Foundation Analysis and Design", McGraw Hill Education (India) Private Limited. ISBN-13 9780071188449. 1175p.
9. Dr. P. Purushothama Raj (2005); "Ground Improvement Techniques", Firewall Media. ISBN-13 – 9788170088370. 266p
10. R. Srinivasan (2009); "Harbour, Dock and Tunnel Engineering", Charotar Publishing House Pvt. Limited. ISBN-13 – 9788185594897. 424p

Sr. No.	Examination	Module
1	T – I	1 , 2
2	T – II	3,5, 6
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE403	**Course :- Irrigation Engineering**		
Prerequisites	**BTC229, BTC277, CE304, CE353**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	-
	Oral	-	-
	Term Work	-	25
	Total		**125**

*60% Weightage for end semester

IRRIGATION ENGINEERING

Irrigation Engineering involves the study and analysis of various water resources systems like dams, canals, spillways, head works, CD works, material and various aspects of construction methodologies adopted in planning of various water resources projects.

Course Objectives:

1. To summarize the fundamentals of water resources systems and to compute the various parameters required for the design of hydraulic structures as per Codal provisions.
2. To acquire the knowledge of hydrological parameters for the discharge calculations.
3. To appraise the various parameters for the design of hydraulic structure, cross drainage work, groundwater and well water system.
4. To discuss different methods of irrigation, water distribution systems and their suitability.

Course Outcomes:

At the end of this course, the students will be able to

1. Design various hydraulic structures and irrigation systems as well as ability to improve the existing dam structures.
2. Examine the economics of water resources project.

Course Content

Module No	**Topics**	**No of Lectures**
1	Introduction Irrigation, water resources in India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems, minor and major command area development	2
2	Water requirement of crops: Crops and crop seasons in India, cropping pattern, duty and delta. Quality of irrigation water. Soil water relationship: soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation. Methods of applying water to the fields: surface, sub-surface, sprinkler and drip irrigation.	6
3	Hydrology:	8

	Hydrologic cycle, rainfall and its measurement, streamflow measurement runoff process, factors affecting runoff, runoff hydrograph, runoff computations, flood discharge calculations, unit hydrograph, S -hydrograph.	
4	Ground water and well hydraulics: Ground water resources, occurrence of ground water, methods of ground water exploration, well irrigation. Well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifer, aquifer tests, design of water wells.	6
5	Reservoir planning: Investigations, selection of site, zones of storage, storage capacity and yield, reservoir sedimentation.	4
6	Dams: Introduction, classification. Gravity dams: forces acting on gravity dam, modes of failure, stability analysis, design, galleries, joints, keys, water seals. Earth and rockfill dams: types, causes of failure, seepage analysis, stability analysis, design, rockfill dams. Arch and buttress dams: types. Spillways and other energy dissipating devices: types.	14
7	Distribution systems: Canal systems, alignment of canals, canal losses, estimation of design discharge.Design of Canal: Kennedy's and Lacey's Theory. Bandhara irrigation Canal outlets: non-modular, semi-modular and modular outlets Waterlogging: causes, effects and remedial measures. Lining of canals: economics of lining. Drainage of irrigated land: necessity, methods. Canal regulation works. Cross drainage works.	8

Term work:-

At least seven assignments covering the entire syllabus shall be submitted as term work.

Recommended Books:-

1. Dr. B.C. Punmia and Dr. Pande B.B.Lal (2009); "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd. New Delhi. ISBN-13 – 9788131807637. 964p.
2. Dr. P.N. Modi (2008); "Irrigation Water Resources and Water Power Engineering" Standard Book House. Delhi. ISBN-13 – 9788189401290. 1070p.
3. S. K. Garg (2009); "Irrigation Engineering and Hydraulics Structures", Khanna Publishers. Delhi. ISBN-13 – 9788174090478. 1594p
4. Challa Satya Murthy (2002); "Water Resources Engineering: Principles and Practice" ISBN-13 – 9788122413823. 306p.
5. S. K. Sharma; "Design of Irrigation Structures", S. Chand and Co. ISBN-13 – 9788121903295
6. R. S. Varshney and R. C. Gupta (1988); "Theory and Design of Irrigation Structures: Canal and storage works" Nem Chand & Bros. ISBN-13 – 9788185240022
7. G.L.Asawa (2006); "Irrigation and Water Resources Engineering", New Age International Publishers. ISBN-13 9788122416732. 624p

Sr. No.	Examination	Module
1	T – I	1,2
2	T – II	3,4,5
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE :CE404	**Course :- Environmental Engineering – II**		
Prerequisites	**CE355,CE302**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

The students will learn to –

1. Design various units of sewerage system and wastewater treatment processes
2. Quantify and analyse the sewage generated by various sources
3. Evaluate sources of air and noise pollution in detail and devise methods for controlling them
4. Utilize environmental laws and environmental management system as a key towards a better society

Course Outcomes:

The students will be able to

1. Design all units of sewerage network and wastewater treatment plant such as grit chamber, screens, biological treatment and sedimentation tanks
2. Analyze the pollution parameters for the wastewater
3. Develop a mitigation plan for noise, soil and air pollution
4. Undertake and hypothesize the environmental audit plan

Course Content

Module No.	**Topics**	**No of Lectures**
1	Air Pollution: i. Definition of air pollution, major episodes, classification of air pollutants, units of quantification, sources of air pollution, natural & man made effects of air pollution on human health, animals. plants, properties. Global atmospheric change, green house effect, ozone depletion, carbon cycle. Effects of carbon dioxide, chlorofluorocarbons, green house gases, effects of temperature increase, emission control.	06
2	Soil/Land Pollution i. Definition, Causes of soil pollution, Effects: Health and ecosystem, Remediation of soil pollution	02
3	Sewage: Conveyance and pumping i. Conveyance of Sewage: Sewers- shapes and materials of sewers, sanitary, storm and combined sewers, capacities and designs, appurtenances, maintenance of sewers. ii. Sewage pumping: Consideration of the selection of pump and	04

	location of pumping stations.	
4	Sewage: Characterization and disposal i. Characteristics of sewage: Composition, chemistry of sanitary sewage, B.O.D., C.O.D., aerobic and anaerobic decomposition. ii. Sewage Disposal: discharge of raw and treated sewage on land and water, standards for disposal, raw and treated sewage on land and water, limits of dilution. iii. Self purification of streams: oxygen economy, sewage farming.	06
5	Sewage treatment: Basic flow sheets and Unit Operations Aims, methods of treatments and various flow-sheets for preliminary, primary, secondary and, tertiary treatment, screens, grit chambers, primary and secondary clarifiers, disposal of screenings and grit.	06
6	Biological treatment methods, principles, trickling filter operation, recirculation, activated sludge process and its modifications, hydraulic design of trickling filter and activated sludge process, sludge volume index, operational problems in activated sludge process and trickling filters, stabilization ponds Sludge digestion: Principles of anaerobic digestion, quantity and characterization of sludge, design of sludge digestion tanks, disposal of digested sludge, drying bed Low cost sanitation: Septic tanks and Imhoff tanks – principles, operation and suitability, design values, disposal of treated effluent	17
7	Environment Auditing, Legislation and Laws Environmental Management System (EMS) ISO 19000 series Legislation and Laws i) Water Act, 1974 ii) Air Act, 1981 iii) Environment protection act (EPA- 1986)	08

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Practical Examination:-

Practical examination will be based on the experiments conducted

Term work:

Report on experiments performed as detailed above, assignments including 10 problems based on the above syllabus (preferably 2 problems on each topic) shall be submitted as term work.

List of Practicals

List of experiments on sewage samples:

1 Determination of pH of sewage
2 Determination of Chlorides
3 Solids: Suspended solids, dissolved solids, total solids, volatile solids
4 Determination of Dissolved oxygen

5 Determination of Chemical oxygen demand(COD) of sewage sample
6 Determination of Biochemical oxygen demand(BOD) of sewage sample
7 To find Sludge volume index (SVI) of sewage sample
8 To find Sulfate in wastewater sample
9 Air : To find PM 10 and PM 2.5 in ambient air
10 Air : To find NO_x and SO_x level in ambient air

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and at least minimum passing in the term-work.

Recommended Books:-

1. E.W.Steel (1947); "Water Supply & Sewage", McGraw Hill, New York. ASIN: B001SL037A
2. T.J.McGhee (1991); "Water Supply & Sewage" McGraw Hill, New York. ISBN-13-9780071008235. 602p.
3. Dr. P.N.Modi (2008); "Sewage Treatment & Disposal & waste water engineering" Standard Book House. ISBN 13 9788190089326. 988p.
4. Garg S. K (2008); "Sewage Disposal & Air Pollution Engineering". Khanna Publication. ISBN 13 978-8174092304. 200p
5. M.N.Rao (1989); "Air Pollution:" Tata McGraw Hill, New Delhi. ISBN 13 9780074518717.339p
6. Nathanson J.A (2014) "Basic Environmental Technology: Water Supply, Waste Management and Pollution Control". Prentice Hall. ISBN-13: 978-0132840149. 456p.
7. J.W. Clark, W.Veisman, M.J.Hammer (2008); "Water Supply and Pollution Control" Prentice Hall. ISBN-13: 978-0132337175. 864p.
8. Gilbert Masters (2013); "Introduction to Environmental Engineering and Science" Pearson Education. ISBN 13 9781292025759. 700p.
9. Manual on Water Supply and Treatment, (latest Ed.): Ministry of & Housing. New Delhi
10. Relevant Indian Standard Specifications, BIS Publications
11. CPHEEO Manual on Water Supply & Treatment

Sr. No.	Examination	Module
1	T – I	1, 2, 3
2	T – II	4, 5, 6 (Partial)
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE : CE407	**Course :-Elective-I : Advanced Structural Analysis**		
Prerequisites	**BTC252, BTC228, CE301**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

- To impart clear understanding of concepts & practical knowledge of advanced and conventional methods of analysis required to design various types of civil engineering structures.
- To apply stiffness matrix method to analyze various real life structures required to design of safe &economical structures.
- To understand development of commercial software using stiffness

Course Outcomes:

After completing the course ,student will be able to

- Analyze various types of structures, using stiffnes matrix method.
- Analyse framed structures using conventional method for prelimary design of structure.
- Use computer software (SAP/ETAB) for analysis of various real life structures.

Course Content

Module No	**Details**	**No of Lectures**
1	**Introduction to Stiffness Method in Matrix Form:** Basic concepts of stiffness coefficients, member stiffness matrix for member of plane truss, member of rigid jointed plane frame, member of plane grid and member of space frame. Properties of stiffness matrix, co-ordinate transformation matrix, stiffness matrix in local and global co-ordinate axes system, assemblage of structural stiffness matrix and application of boundary conditions.	8
2	**Stiffness Matrix Method contd…** Joint loads, Equivalent joint loads, method of solution for displacements and computation of internal forces in members. Application of stiffness method to beams, pin jointed trusses, rigid jointed plane frames and simple plane grid structures.	5
3	**Conventional Form of Stiffness Method, Modified Moment Distribution Method**: Symmetric structure, Symmetric and anti-symmetric loads, Modification of stiffness and carryover factors for symmetric and anti-symmetric loads both for sway and non-sway cases for frames with different support conditions. Application to frames involving side sways.	07
4	**Flexibility Method in Matrix Form:**	05

	Review of concepts of flexibility coefficients, Selection of primary structure, concept of structure flexibility matrix, compatibility equations, solution for redundant forces, computational of internal forces, and joint displacements. Application to pin jointed trusses and rigid jointed plane frames for different loading including the effect of settlement of support, temperature changes and elastic supports. **Conventional Form of Flexibility Method:** Elastic Center Method and its application to rectangular box, rigid jointed portal frames and fixed arches. Column Anology Method and its application to analysis of non prismatic beams, simple rectangular frames, determination of stiffness coefficients and carry over factors for non prismatic beam members.	08
5	**Influence Line Diagrams for Indeterminate Structures:** Muller Breslau's Principle for drawing influence line diagrams for statically indeterminate structures. Influence Lines Diagrams for propped cantilevers, fixed beams and continuous beams.	06
6	**Approximate Methods for Analysis of Building Frames:** Approximate methods for gravity loads: Substitute frame and equivalent frames. Approximate methods for lateral loads: Portal and cantilever method.	04
7	**Plastic Analysis of Steel Structures:** Application to single bay single storey rectangular frames.	03

Term work:-

At least 20 (twenty) solved problems based on the above syllabus shall be submitted as term work. Exposure to computer aided analysis using available software be considered.

Text Books:-

1. Basic Structural Analysis: Reddy C.S., Tata McGraw hill.
2. Intermediate Structural Analysis: Wang C.K., Tata McGraw hill.

Reference Books:-

1. Matrix Method in Structural Analysis: Livesley R. K., Pergamon Press, London.
2. Analysis of Framed Structures: Gere and Weaver, East-West Press.
3. Elementary Structural Analysis: Wilber, McGraw Hill, New York.
4. Analytical Method in Structural Analysis: S.A. Raz, New Age Int Publishers
5. Modern Methods in Structural Analysis: Dr. B.N. Thadani and Dr. J. P.Desai,Weinall Book Corporation.
3. Plastic Methods of Structural Analysis: B.G.Neal, Chapman & Hall, London.
4. Structural Analysis Vol.I and Vol. II: Pandit and Gupta, Tata McGraw hill.
5. Matrix Method in Structural Analysis: Pandit and Gupta, Tata McGraw hill.
6. Matrix Methods of Structural Analysis: Dr. A. S. Meghre, S. K. Deshmukh, Charotar Publishing House.
7. Structural Analysis: In Theory & Practice: Alan Williams, Butterworth-Heinemann, 2009
8. Fundamentals of Structural Analysis: Kenneth M Leet, Chia-Ming Uang & Anne M Gilbert, Tata McGraw hill.
9. Matrix Structural Analysis: Ronald L Sack, Waveland Press, 1994
10. Plastic Thoery of Structures: Michael R Horne, Elsevier, 2014
11. Advanced Methods of Structural Analysis: Igor A Karnovsky, Olga Lebed, Springer Science & Business Media, 2010
12. Structural Analysis: A Unified Classical & Matrix Approach: Amin Ghali, Adam Neville & T G Brown, CRC Press, 2013
13. Statically Indeterminate Structures: Approximate Analysis by Deflected Structures &

Lateral Load Analysis: Jack R Benjamin, Literary Licensing, 2012		
Sr. No.	**Examination**	**Module**
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester-VII**
CODE: CE408	**Course :- Elective-I: Advanced Computational Techniques**		
Prerequisites	**BTC226**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To discuss different methods of statistics, probability theory and its application in construction Industry.
2. To outline different methods of data collections for civil engineering problems, its use in statiscs and Hypothesis.
3. To explain the application of linear programming problem and transportation problem in construction industry.

Course Outcomes:
Student wiil be able:

1. To identify the method of data collection for statistical analysis and testing of hypothesis.
2. To implement the concept of probability theory in civil engineering projects.
3. To formulate a linear Programming Problem and Transportation Problem for optimization of civil engineering projects.

Course Content

Module No	**Topics**	**No of Lectures**
1	Review of basic statistics and probability : Probability Distributions, Theoretical : binomial, poisson, normal, exponential, hypergeometric, uniform	7
2	Sampling and Sampling Distributions Probability and non-probability samples, sampling and non-sampling errors Sample size, sampling distributions : t, F and χ^2 distributions	5
3	Hypothesis Testing Type I and II error, testing of mean, proportion, tests for equality of mean and variances of two populations, confidence interval, χ^2 test for goodness of fit, ANOVA (one way classification), Non parametric tests : sign test, U test	8
4	Correlation and Regression Karl Pearson's and Rank Correlation coefficient, simple linear regression : least squares method	5
5	Management Decision Making	7

	System approach, decision making under uncertainty and risk: decision tables and decision tree.	
6	Linear Programming Graphical solution, simplex method, dual, sensitivity analysis, transportation and assignment problems	10
7	Intoduction to Genetic Algorithms	6

Term work:-
Minimum eight assignments shall be submitted as term work.

Recommended Books:-
1. Quantitative Techniques for Managerial Decisions: Shrivastava, Shenoy & Sharma, Wiley
2. Research Methodology: Kothari C R, Wiley Eastern
3. Methods in Social Research: Goode W J & Hatt P K, McGraw Hill
4. Handbook of Genetic Algorithms (1991): L. D. Davis, Melanie Mitchell. Van Nostrand Reinham
5. An Introduction to Genetic Algorithms (1998): Melanie Mitchell, Van Nostrand Reinham

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:-B.Tech. (Civil)			**Semester-VII**
CODE: CE409	**Course :- Elective-I: Applied Hydrology and Flood Control**		
Prerequisites	**CE304, CE353**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	**Marks**
Scheme of Evaluation	In Semester	01	20 x 02
	End Semester*	03	100
	Practical/MCQ	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To discuss scope of hydrology and hydrologic parameters.
2. To summarize hydrographs along with estimation and design flood control methods.
3. To describe reservoir and channel routing techniques and its applications.
4. To summarize ground water hydrology theories along with yield estimation.

Course Outcomes:

At the end of this course, students will be able :

1. To estimate precipitation, runoff and water losses along with stream flow measurements by various techniques.
2. To carry out the flood estimation, its routing techniques along with importance of flood frequency studies and applications of probabilistic as well as stochastic methods in flood estimation.
3. To execute the estimation of ground water flows along with surface flow.

Course Content

Module No	**Topics**	**No of Lectures**
1	Introduction: Hydrological cycle, scope of hydrology, water budget equation, sources of data.	03
2	Precipitation and Water Losses: Measurement, rainfall records, missing data, mass curve analysis, station year method, depth - area - duration relationship, intensity - duration - frequency relationship. Water losses: Evaporation, evapotranspiration, interception, initial loss, infiltration. Determination of water losses.	10
3	Streamflows and Runoff: Stream gauging techniques, latest methods of measuring depths, current meter-types-calibration, mid section and mean section methods, rating curves. Runoff: Factors affecting runoff, rainfall-runoff relationship, runoff estimation, droughts.	10

4	Hydrograph analysis: Charactereristics, base flow separation, unit hydrograph, S-hydrograph, complex hydrograph, synthetic hydrograph, dimentionless unit hydrograph, instantaneous unit hydrograph.	10
5	Floods and Flood routing: Estimation, envelope curves, flood frequency studies, probability and stochastic methods, estimation of design flood, flood control methods, limitations, risk-reliability and safety factor.Reservoir routing, channel routing.	10
6	Hydrological forecasting: General operation of flood forecasting, forecasting methods adopted in India, forecasting by unit hydrograph method.	08
7	Ground water hydrology: Yield , transmissibility, Darcy's law, Dupuit's theory of unconfined flow, steady flow towards fully penetrating wells (confined and unconfined) Unsteady flow towards wells: Jacob's curve and other methods, use of well function, pumping tests for aquifer characteristics, methods of recharge.	09

Term work:-
Assignments (on each module) consisting of theory and problems covering entire syllabus shall be submitted as term work.

Recommended Books:-

1. Engineering Hydrology: K. Subramanya, Tata McGraw Hill Publishing Co. Ltd.. New Delhi.
2. Hydrology: H. M. Raghunath, New Age International Publishers, New Delhi
3. Elementary Hydrology: V. P. Singh, Prentice Hall
4. Engineering Hydrology: Principles and practice: V. M. Ponce, Prentice Hall
5. Hydrology and Water Resources Engineering: K. C. Patra, Narosa Publishing House, New Delhi.
6. A Text Book of Hydrology: Dr. P. Jayarami Reddi, Laxmi Publications Pvt. Ltd. New Delhi.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE : CE410	**Course :-Elective-I : Solid Waste Management**		
Prerequisites	**CE355, CE404**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

The students will learn to –

1. Explain the various units in integrated solid waste management
2. Quantify and qualify the solid waste
3. Utilize solid waste as renewable energy
4. Deliberate and propose the kind of collection system to be used
5. Design flowsheets based on various characterization of waste

Course Outcomes:

The students will be able to -

1. Design all units of solid waste management
2. Evaluate Quantities of waste generated
3. Analyse the type of waste generated and its end use
4. Demonstrate various laws related solid waste management

Course Content

Module No	**Topics**	**No of Lectures**
1	Definition of solid waste Domestic: garbage, ashes, rubbish, dust, debris. Commercial: wastes from offices, shops and markets etc. Hazardous waste: household, industrial.	04
2	Sources, Quality and Quantity of solid wastes : Household wastes. Waste from commercial establishments, offices, vegetable markets, fish and meat markets, stables. Solid waste from construction activities. Hospital wastes, dead animals. Quantity, composition and properties of solid wastes : Per capita municipal solid waste. Quantity of industrial solid waste per unit produced. Compositions: physical, chemical and biological constituents. Sampling and characterization of solid wastes.	08

3	Collection, segregation, storage and transportation of solid waste : House to house collection, collection centers: location, sizes, types and maintenance. Transportation methods: manual, mechanical, methods with or without compaction, economy in transportation of waste, optimization of transportation routes.	05
4	Disposal of solid waste : Segregation, reduction at source, recovery and recycle Disposal methods : pen dumping, sanitary land filling, composting- anaerobic and aerobic, incineration, sea disposal, vermin-composting Modern trends : Thermal, biological and chemical conversion technologies.	12
5	Industrial solid waste: Waste products during manufacture, filling and parking, operation of pollution control facilities, generation, minimization at source, recycling and disposal.	05
6	Introduction to hazardous waste: generation, minimization at source, treatment and disposal.	04
7	Effect of solid waste on environment: effects on air, soil, water surface and ground, health hazards Municipal solid waste in Indian conditions, legal aspects of solid waste disposal.	07

Term work:-

Each student shall prepare a report on any industrial / hazardous / municipal solid waste comprising source, characterization, transportation, recycles, treatment and disposal.

The report mentioned above, assignments shall be submitted as term work.

Recommended Books:-

1. Integrated Solid Waste Management: Techobanglous, Thisen and Vigil, McGraw Hill International.
2. Hazardous Waste Management: Lagrega, Buckingham and Evans, McGraw Hill International.
3. Solid Waste Management in Developing Countries: A.D. Bhide, Nagpur publications
4. Environmental Pollution Control Engineering: C.S. Rao, Wiley Eastern, Manual of solid waste of management, CPHEEO

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester-VII**
CODE : CE 411	**Course :- Elective-I: Advanced Surveying**		
Prerequisites	**BTC202, BTC227**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

A surveyor enjoys diverse responsibilities as part of his or her everyday routine. Surveying technicians primarily work outside collecting data and establishing control points and boundaries. Others work inside an engineering office helping in site design activities and developing plans from the field data.

Course Objectives:
The students will learn:

1. To acquire the knowledge of modern surveying equipments, remote sensing techniques such as photogrammetry, remote sensing, geographical information systems (GIS), and the global positioning system (GPS).
2. Astronomical surveying and hydrographic surveying.
3. To use state-of-the-art surveying equipments and software's in conjunction with the fundamentals of civil and site design.

Course Outcome:
The student will be able to

1. Demonstrate an appropriate mastery of fundamental knowledge and tools, including surveying methods, GIS, GPS, RS and other technological processes inherent to their specific field of study.
2. Apply fundamental knowledge along with these current techniques and skills to conduct experiments, analyze data, interpret and apply results to improve processes.

Course Content

Module No	**Topics**	**No of Lectures**
1	Modern Surveying Equipment: Data and equipment needed for engineering projects. Review of traditional surveying equipment. Changing scene in surveying and mapping, map substitutes, use and advantage of modern surveying equipment in project. Modern surveying electronic equipment, their principles, constructions working and use – Electronic Theodolite, E.D.M. Instruments- Geodimeter, Tellurometer, Distomat, Total station. Application of lasers in distance and angular measurements. Introduction of electronic navigation and position fixing. Different systems and their characteristics.	05
2	Global Positioning System :	05

	Introduction to navigation and positioning, Geodesy; geospatial reference systems, overview of GPS; GPS segments, 2D and 3D positioning, GPS error sources and handling, GPS applications.	
3	Geographic information system: Geographic Information System (GIS) – Definition of GIS, Geographical concepts and terminology, Components of GIS, Data acquisition, Raster and vector formats, scanners and digitizers. Advantages of GPS and GIS in the storage thematic information extracted from remotely sensed images.	05
4	Photogrammetry& Image Interpretation: Definition of photogrammetric terms, geometry of aerial and terrestrial photographs, aerial camera and photo theodolite, scales of photographs, tilt and height displacements , stereoscopic version and stereoscopes, height determination from parallax measurements, flight planning , maps and map substitutes and their uses. Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth- collection and verification, advantages of multidate and multiband images, digital image processing; introduction, image enhancement techniques, digital image classification.	12
5	Remote sensing: Introduction and definition of remote sensing terms, remote sensing system, principles of remote sensing, Interaction of EMR, Fundamentals of aerial photography, platforms and orbits, sensors, data products, principles of visual interpretation, principles and uses; thermal remote sensing, microwave remote sensing.	08
6	Field astronomy: Terms, coordinate systems, hour angle, right ascension, declination, altitude, azimuth: study of astronomical charts, determination of latitude and bearing by observation on the sun and polestar, time, standard time, local time, universal time, equation of time.	08
7	Hydrographic surveying: Uses, Method of hydrographic surveys, mean sea-level, tide gauges, sounding equipments, location of soundings, the capacity of reservoir, stream gauging.	05

List of Practical:-
At least three practicals based on the above syllabus are to be conducted.

Term work:-
Report on the practicals conducted, at least five Assignments covering entire syllabus shall be submitted as term work.

Recommended Books:-

1. Higher surveying: A.M. Chandra New Age International publishers.
2. Higher surveying: B.C. Punamia, Ashok jain, Arun k. jainLaxmi publications (P), Ltd,
3. Geographic Information Systems and Science, Second Edition: Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind. 2005.. John Wiley & Sons, New York.
4. Modeling Our World: The ESRI Guide to Geodatabase Design: Zeiler, M. 1999,. ESRI Press, Redlands, California
5. GIS, Spatial Analysis, and Modeling: Maguire, D., M. Batty, and M. Goodchild. 2005. ESRI Press (G70.212 .G584 2005)

6. 6 Global Positioning System: Signals, Measurements, and Performance, Second Edition (2006): PratapMisra and Per Enge
7. Remote Sensing Principles and Interpretation: Floyd, F. Sabins, Jr:, Freeman and Co., San Franscisco, 1978.
8. Remote Sensing and Image interpretation: Lillesand and Kiefere:, John Wiley, 1987.
9. A remote sensing perspective: Introductory Digital Image Processing:, John R. Jensen,Prentice Hall.
10. Imaging Radar for Resource Survey: Remote Sensing Applications: W Travelt, Chapman & Hall.

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE412	**Course :-Elective-I : Advanced Repair and Rehabilitation of Structures**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objective	1. To understand need for repair and rehabilitation. 2. To develop clear understanding of concepts, and practical knowledge of modern Civil Engineering techniques. 3. To encourage students and faculty to interact with industry, alumni and other reputed institutes for purpose of better understanding of industry requirements and different materials used. 4. To deal with social, environmental and economic issues when applying various techniques..
Course Outcome	1. Application of various repair techniques as per the requirement of the problem. 2. To act as catalyst in transferring the Civil Engineering knowledge to field usage for the socio-economic development of the society. 3. To provide a platform to students, scientists, engineers and working professionals to come together and implement the academic outcome to the field.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Introduction: Need for strengthening due to various reasons such as ageing, natural calamities, increase of load, change of function and design, construction errors	4
2	Structural Strengthening: Strengthening and retrofitting of columns, beams, walls, footings and slabs, piers of concrete structures by jacketing, external post-tensioning, replacing or adding reinforcement, plate bonding, textile reinforced concrete	11
3	Specialized Repairs: Electro chemical repair using re-alkalization and chloride extraction techniques, Specialized repairs for chemical disruption, fire, marine exposure etc, Repair of damaged structures of water retaining structures, hydraulic structures, Pavements and Runways, Tunnels, Bridges, Piers and Flyovers, Parking Garages, Underwater repair, Masonary Repair, Repair and Restoration of Heritage Structures	11
4	Seismic Retrofitting:	6

	Seismic strengthening of existing RC structures, Use of FRP for retrofitting of damaged structures	
5	Retrofitting by composite materials: Fiber reinforced concrete, Ultra-high performance fibre reinforced concrete (UHPFRC), Fiber reinforced composites, Carbon fibre reinforced polymer (CFRP), Fibre wrapping (Carbon, Aramide, Glass)	10
6	Post-Repair Maintenance of Structures: Protection & Maintenance schedule against environmental distress to all those structures	4
7	Heritage Structures	2

Term work:-
At least 8 assignments shall be submitted as term work.

Recommended Books:-

1. Concrete Repair and Maintenance: Peter H .Emmons and Gajanan M. Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation-Compilation from Indian Concrete Journal-ACC Publication.
3. Guide to Concrete Repair and Protection, HB84-2006, A joint publication of Australia Concrete Repair Association, CSIRO and Standards Australia.
4. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG(Works), CPWD, Government of India (Nirman Bhawan), http://www.cpwd.gov.in/handbook.pdf
5. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center , http://books.google.co.in
6. Management of Deteriorating Concrete Structures: George Somerville, Taylor and Francis Publication
7. Concrete Building Pathology: Susan Macdonald, Blackwell Publishing.
8. Testing of Concrete in Structures: John H. Bungey, Stephen G. Millard & Michael G. Grantham, Taylor & Francis Publication.
9. Durability of concrete and cement composites: C.L.Page & M.M. Page,Woodhead Publishing
10. Concrete Repair, Rehabilitation and Retrofitting: M. Alexander, H. D. Beushausen, F. Dehn & P. Moyo, Taylor & Francis Publication
11. Concrete Repair Manual, Volume I & II, Published jointly by ACI, BRE, Concrete Society, ICRI

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE413	**Course :-Elective-I : Systems Approach in Civil Engineering**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. Student should be able to develop the skill for problem formulation and should be able to understand various components for formulating a problem
2. To develop decision making Specially under uncertain Scenario
3. Students should be able to formulate LPP, Distribution and queuning models and should able to analyse them.

Course Outcomes:

Graduate students should be able to develop capability in solving various civil engineering activites related to infrastructural projects by formulating problems and modules related to LPP, Distribution quening. They should be able to analyse and come to appropriate decision making.

Course Content

Module No	**Topics**	**No of Lectures**
1	Concept of systems approach: system, boundaries of system, goals and objectives, optimality, mathematical models, objective function and constraints, problem solving mechanism, types of problems, modeling / problem formulation, sub-optimization, solution techniques, sensitivity analysis	06
2	Decision theory: classification of decision situations, decision tables and decision tree, criteria for decision making under certain, uncertain and risk conditions, utility theory	05
3	Time series analysis: variations in time series, trend analysis: method of moving averages, method of least squares	05
4	Index numbers: basic requirements of index numbers, constructing index numbers: using relatives, using aggregates	04
5	Linear programming: general nature of problem, formulation of problems, graphical method of solution, simplex method, dual, sensitivity analysis	07
6	Distribution models: transportation and assignment problems and their solutions	06
7	Queuing models: various situations, queue discipline and customer	06

	behaviour, single server model	

Term work:-
At least two assignments and 3 problems on each of the topic shall be submitted as term work.

Recommended Books:-

1. Systems Analysis for Civil Engineers: Ossenbruggen P J
2. Quantitative Techniques for Managerial Decisions: Shrivastava, Shenoy & Sharma, Wiley Eastern

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE414	**Course :- Elective - I Risk and Value Management**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**125**

*60% Weightage for end semester

Course Objectives:

1. To discuss the basics of risk and value management.
2. To explain various mathematical tools used in risk assessment process.
3. To describe value engineering job plan.
4. To outline the process of life cycle costing.

Course Outcome:

1. To carry out risk analysis and development of mitigation measures.
2. To implement value management process.
3. To execute the life cycle cost analysis.
4. **Course Content**

Module No	**Topics**	**No of Lectures**
1	Basic concept of Risk & Value Management, Definition of Risk, Types of risk, Risk & Uncertainty, Failure Mode Effect analysis, Performance Measures, Scope of risk control during project life cycle.	08
2	Decision analysis, Determination of Risk Values, Formalization of Quantitative Risk Assessment, Probabilistic Risk Assessment,	04
3	Risk Registers, Risk priority number, Risk identification, analysis & response measures, Probability Impact matrix.	04
4	Risk analysis in construction projects, Sensitivity analysis, Break even analysis, Scenario analysis, Decision trees, Monte-Carlo simulation, Spider diagram, Probability contours.	04
5	Value analysis, Factors contributing to value analysis, principles of value analysis, Elements of value analysis, benefits of value analysis & applications.	08
6	Six steps in value Engineering plan, Function analysis, creativity & innovation, performance & cost comparisons, Followups, Value Engineering in construction Design	06
7	Life cycle costing, Forecasting operating & maintenance costs, time Value, Presesent worth analysis, DCF Method, ROR Analysis	06

Term work:-
Assignments consisting of minimum twenty problems covering entire syllabus shall be submitted as term work.

Recommended Books:-

1. Risk & Decision Analysis in projects, John Schuyler,PMI.
2. Risk Management & Construction, Roger Flangan & George Norman, Blackwell science
3. Risk Management for Design & Construction, Ovidiu Cretu, Robert B. Stewart and Terry Berends
4. Value Engineering Manual

Sr. No.	Examination	Module
1	T – I	1,2 & 3
2	T – II	4,5,6 & 7
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE : CE415	**Course :-Elective-I : Structural Dynamics**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives :

- To develop civil engineering graduates having clear understanding of concept of dynamic loads, dynamic analysis & seismic analysis of structures.
- To apply knowledge of structural dynamics to understand the behavior & to find the response of various structures subjected to dynamic load.
- To apply knowledge of Random Vibration analysis to study the behavior of structure subjected to earthquake loads.

Course Outcomes

After completing the courses students will be able to:

- Distinguish the difference between static and dynamic analysis of structure
- Carry out the dynamic analysis of various types of structures for different types of dynamic loads.
- Use of random vibration concept to understand the behavior of structures under earthquake loads.

Course Content

Module No	**Topics**	**No of Lectures**
1	Introduction: Introduction to structural dynamics, definition of basic problem in dynamics, static v/s dynamic loads, different types of dynamic loads.	02
2	Single degree of Freedom (SDOF) systems: Undamped vibration of SDOF system, natural frequency and period of vibration, damping in structures, viscous damping and coulomb damping, effect of damping on frequency of vibration and amplitude of vibration, logarithmic decrement. Forced vibration, response to harmonic forces, periodic loading, dynamic load factors, response of structure subjected to general dynamic load, Duhamel's integral, numerical evaluation of dynamics response of SDOF systems subjected to different types of dynamic loads. Introduction to frequency domain analysis, response of structure in frequency domain subjected to general periodic and non-periodic / impulsive forces of short duration, use of complex frequency response function. Use of Fourier Series for periodic forces, introduction to vibration isolation. Distributed mass system idealized as SDOF system, use of Rayleigh's method, response of SDOF system subjected to ground motion.	16

3	Generiilized Single-Degree of Freedom System: Generalized properties, assemblages of rigid bodies, systems with distributed mass and elasticity, expressions for generalized system properties.	03
4	Lumped mass multi degree of freedom (MDOF) system: Coupled and uncoupled systems, direct determination of frequencies of vibration and mode shapes, orthogonality principle, vibration of MDOF systems with initial conditions, approximate methods of determination of natural frequencies of vibration and mode shapes-vector iteration methods, energy methods and use of Lagrange's method in writing equations of motions. Decoupling of equations of motion, modal equation of motion, concept of modal mass and modal stiffness, forced vibration of MDOF system, modal analysis, application to multi storey rigid frames subjected to lateral dynamic loads.	10
5	Structure with distributed mass system: Use of partial differential equation, free vibration analysis of single span beams with various boundary conditions, determination of frequencies of vibration and mode shapes, forced vibration of single span beams subjected to the action of specified dynamic loads.	04
6	Random Vibrations: Probability theory: Single random variable, important averages of single random variable, two random variables, important averages of two variables, principal axis of joint probability density function, Rayleigh's probability density function. Random processes, stationary and ergodic processes, autocorrelation function, power spectral density function, relationship between power spectral and autocorrelation functions, power spectral density and autocorrelation functions for derivatives of processes, superposition of stationary processes, stationary Gaussian processes, stationary white noise, probability distribution for maxima and extreme values.	08
7	Stochastic Response of Linear SDOF Systems: Transfer functions, relationship between input and output autocorrelation functions, relationship between input and output power spectral density functions, response characteristics for narrowband systems	05

Term work:-
At least 20 (twenty) solved problems based on the above syllabus shall be submitted as term work. Exposure to computer aided analysis using available software be considered.

Text Books:-

1. Dynamics of Structures by Clough & Penzien, McGraw-Hill, Computers & Structures, CBS Publishers, 2015
2. Dynamics of Structures: Theory & Applications to Earthquake Engineering by Anil K Chopra, Prentice Hall of India

Reference Books:-

1. Structural Dynamics by Mario Paz, Springer India, CBS Publishers, 2004
2. Introduction to Structural Dynamics by John M Biggs, CBS Publishers,2014

3. Basic Structural Dynamics by James C Anderson & Farzad Naeim, John Wiley & Sons
4. Fundamentals of Structural Dynamics by Roy R Craig & Andrew J Kurdia, Wiley
5. Mechanical Vibrations by Den P Hartog, McGraw-Hill
6. Dynamics of Structures by Jagmohan L Humar, 3rd Edition, CRC Press,
7. Wind Effects on Structures by Simiu E & Scanlan R H, Wiley
8. Wing Loading of Structures by John D Holmes, Spon Press
9. Structural Vibration: Analysis & Damping by Beards C F, Arnold
10. Vibrations & Control System by Beards C F, Ellis Horwood
11. Passive Energy Dissipation Systems in Structural Engineering by Soong T T & Dargush G F, Wiley
12. Introduction to Structural Motion Control by Connor J J, Prentice Hall, NJ
13. Active Structural Control by Soong T T, Wiley, NY & Longman Scientific & Technical, England
14. Liquid Sloshing Dynamics by Ibrahim, Cambridge University Press
15. Structural Damping: Applications in Seismic Response Modification by Zach Liang, George C Lee, Gary F Dargush & Jianwei Song, CRC Press
16. MATLAB: An Introduction with Applications by Amos Gilat, Wiley India

1.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE416	**Course :-Elective-I : Advanced Structural Mechanics**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives

The main objectives of the course:

- To Introduced to the advanced topics of structural mechanics

Course Outcomes

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

- Determine Shear Centre of thin walled open sections and analyze beams/members with large initial curvature
- Analyse beams on elastic foundation and beams curved in plan
- Use suitable failure theory to find the failure stress
- Analyse deep beams and non circular solid sections subjected to torsion

Course Content

Module No	Topics	No of Lectures
1	Shear Centre for symmetrical and non-symmetrical (about both axis) thin walled open sections	06
2	Bending of beams with large initial curvature loaded in their plane of curvature. Application to analysis of hooks, circular closed rings, chain links with straight length and semi-circular ends.	08
3	Beams on elastic foundation: Analysis of beams of infinite length Course ed to concentrated force/moment and semi infinite length subjected to concentrated load/moment at one end. Semi infinite beam hinged at one end (origin)& subjected to UDL throughout.	08
4	Beams curved in plan: Analysis of beams loaded perpendicular to their own plane, simply supported, fixed and continuous beams.	06
5	Theories of Failure: Maximum principal stress theory, Maximum principal strain theory, Maximum shear stress theory, maximum total strain energy theory..	06
6	Analysis of deep beams: Determination of deflection. Determination of shear correction factor for various sections rectangular solid and hollow section and circular solid and hollow section and I-section	06
7	Torsion in non circular solid section rectangle, triangular and hexagon section	08

Term work:-At least 20 solved problems based on the above syllabus shall be submitted as term work.

Text Books:-

1. Mechanics of Materials: E.P. Popov, Prentice Hall of India Pvt. Ltd.

2. Mechanics of Materials: James M. Gere, Thomson Brooks.
3. Mechanics of Materials: F.P. Beer, E. Russell Jhonston and John T. DeWolf, TMH, New Delhi.
4. Advanced Mechanics of Materials: Arthur p. Boresi and Omar M. Sidebottom, Wiley & Sons.
5. Advanced Mechanics of Materials: Arthur p. Boresi and Richard Schmidt, John Wiley & Sons.
6. Strength of Material Part I and Part II: Timoshenko, McGraw Hill, New York.
7. Mechanics of Solids: Shames I & J.M. Pitarresi, Preentice Hall, New Delhi.
8. Beams on Elastic Foundation: Heteny M.
9. Strength of Materials: Subramanian, Oxford University Press.

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE417	**Course :-Elective-I : Advanced Foundation Engineering**		
Prerequisites	**CE302, CE351**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

In this course, students are taught about the higher level applications of the topics learnt during GE-I and GE-II. They will be exposed to the field applications in the form of completion and submission of mini projects.

Course Objectives

1. Highlight the importance of site exploration and characterization, purpose, scope and methods.
2. Apply the consolidation theory, use appropriate laboratory tests and field curves, introduce concept of quasi-consolidation
3. Predict the stress-strain behaviour of soil and estimate stresses in soil using various theories
4. Analyze and estimate bearing capacity and settlement of shallow foundations and estimate pile capacity by various methods
5. Explain methods of ground improvement

Course Outcome:

The students will be able to

1. Apply the basics explained in earlier semester to complex and practical problems in design and construction of foundations.
2. Plan and handle simple site projects based on the field data provided to them.

Course Content

Module No	**Topics**	**No of Lectures**
1	**Site Exploration and Characterization** Purpose and scope, influence of soil conditions and type of foundation on exploratory programme, project assessment, phasing of site exploration, excavation and boring methods of exploration, types of samplers and their design features, subsurface soundings – static and dynamic methods, planning of subsurface investigations, type and sequence of operations, lateral extent and depth of exploration, interpretation of field and laboratory data.	06
2	**Consolidation** Terzaghi's theory of one-d consolidation – derivation of equation (solution in detail need not be covered), estimation of C_c and C_v from laboratory tests, estimation of P_c by various methods, field consolidation curves, Quasi-	10

	preconsolidation and secondary consolidation, practical applications.	
3	**Stress and Strain Behaviour of Soils** Triaxial test - drained and undrained behaviour of sands and clays, failure criteria in soils - only Mohr - Coulomb's criteria, ideal, plastic and real soil behaviour, shear strength of sands and clays.	06
4	**Estimation of Stresses** Boussinesq's theory, vertical stress due to concentrated load, horizontal and shear stress due to concentrated load, Isobar diagram, vertical stress distribution on horizontal plane, influence diagram, vertical stress distribution on vertical plane, vertical stress due to line load, vertical stress under strip load, maximum shear stress at points under strip loads, vertical stresses under a circular area, vertical stress under a corner of a rectangular area, Newmark's influence charts, Westergard's theory.	04
5	**Bearing Capacity and Settlement Analysis of Shallow Foundations** Modes of failure, failure criteria, – Terzaghi solutions, Vesic's solutions, IS Code recommendations, assumptions in estimates of ultimate loads, effect of shape, embedment of footing, eccentricity in loading,compressibility (including critical rigidity index), choice of factor safety, settlement of foundations on sand – Schmertmann method, Plate load test, evaluation of bearing capacity using standard penetration test, Housel Method	12
6	**Pile Foundations** Use of load tests, Estimation of single pile capacity by static and dynamic methods, Group capacity in sand and clay deposits, Separation of skin friction and end-bearing capacity. Settlement of single and group of piles,	06
7	**Ground Improvement** Improvement of deep cohesionless soils and cohesive soils (including stone columns / band drains), instrumentation – mainly pore pressure gauges and settlement gauges and their applications.	04

Term work:-

A project report covering the selection of soil parameters and design of shallow / pile foundations and ground improvements, using stone columns and sand drains shall be submitted as term work.

Text Books:-

1. Soil Mechanics and Foundation Engineering, Volume I and II: V. N. S. Murthy, Saitech Publication.
2. Soil Mechanics in Engineering Practice: K. Terzaghi and R. B. Peck – Second Edition, Wiley International Edition.
3. Foundation Engineering Handbook: Winterkorn and Fang, Galgotia Publications.
4. Foundation Design Manual: N. V. Nayak - Dhanpat Rai Publications (P) Ltd.
5. Principles of Foundation Engineering: Braja M. Das – PWS Publishing
6. Relevant IS Codes, BIS Publications

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	4,5
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE418	**Course :-Elective-I: Ground Water Hydrology**		
Prerequisites	**CE304, CE353**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	**Marks**
Scheme of Evaluation	In Semester	01	20 x 02
	End Semester*	03	100
	Practical/MCQ	-	25
	Laboratory work (Joournal)	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To describe principles of ground water flow,steady and unsteady flow into a well along with methods of construction.
2. To explain ground water modelling techniques for flow analysis.
3. To summarize environmental influences and pollution of ground water.
4. To summarize concept of ground water basin management.

Course outcomes:

At the end of this course, students will be able:

1. To use principles of ground water flow.
2. To utilize methods of well construction and development of wells.
3. To formulate model of ground water flow with various techniques.
4. To check time variation of ground water levels, its fluctuations and effects of urbanization, earthquake and tsunami.
5. To monitor conjunctive use of ground water.

Course Content

Module No	**Topics**	**No of Lectures**
1	**Principles of ground water flow:** Ground water occurrence, Darcy's Law, aquifers, estimation of aquifer parameters, steady and unsteady flow equations, steady one dimensional flow in confined and unconfined aquifers, drainage using tiles, flow through leaky aquifer, flow into infiltration galleries.	08
2	**Well Hydraulics:** Steady and Unsteady flow into a well, spacing of wells, well loss, ground water quality, sea water intrusion, Surface and subsurface investigations of ground water, ground water recharge estimation, ground water budgeting, water logging, flow net analysis, methods of well construction, well completion, development of wells.	10
3	**Ground water modelling techniques:** Porous media models, analog and electric analog models, digital computer models,	08
4	**Numerical modelling of ground water flow:** Finite difference methods, one dimensional flow model, Explicit approximation , Implicit approximation for 1-D flow domain and 2-D flow	10

	domain, Boundary conditions	
5	**Ground water levels and Environmental influences:** Time variation of levels, ground water fluctuations, urbanization, earthquakes and tsunami, land subsidence and ground water	08
6	**Pollution of ground water:** Pollution in relation to water use, sources and causes-municipal, agricultural, industrial, miscellaneous, attenuation of pollution , evaluation of pollution potential, monitoring ground water quality	08
7	**Management of Groundwater:** Concept of basin management, Ground water basin investigations, basin management and conjunctive use, basin yields	08

Term work:-
Assignments consisting of minimum 30 problems covering entire syllabus shall be submitted as term work.

Text Books:-

1. Numerical Ground Water Hydrology: A.K. Rastogi, Penram International Publishing, Mumbai, 2007
2. Ground Water Hydrology: D.K.Todd, John Wiley &Sons, New York, USA, 1980
3. Engineering Hydrology: C.S.P.Ojha, R.Berndtsson, &P.Bhunya:, Oxford University Press
4. Hydrology- Principles, Analysis, Design: H.M.Raghunath, New Age International Publishers.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE419	**Course :-Elective-I : Pavement Subgrade and Materials**		
Prerequisites	**CE305, CE354**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To describe the different layers of flexible and rigid pavement.
2. To explain the function of subgrade, properties of subgrade material and its determination.
3. To discuss the importance of drainage system, its design and ground improvement techniques.

Course Outcomes:

At the end of course students will be able

1. Idenitfy the quality of material to be used in subgardes and other pavement layers and demonstrate laboratory and field test.
2. Utilize the knowledge gained for the analysis and design of surface and subsurface drainage system.
3. Appraise different ground improvement technique, use of different stabilizer like, lime, fly ash, fibers in highway subgrade.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Subgrade: Functions, Importance of subgrade soil properties on pavement performance, subgrade soil classification for highway engineering purpose soils as per PRA system, revised PRA system, Burmister system, Compaction system.	10
2	Grading requirements for aggregate, selection of bases and subbase material (including stabilized materials), selection of different grade of bitumen, types of bituminous surfaces, skid qualities, bituminous mix design, Marshall stability test, design aspect of paving concrete. Experimental characteristics of road aggregate.	06
3	Soil Survey: Soil Survey Procedure for Highway and Ground Water Investigation. Identification and Significance of soil Characteristics, effect of water in soil Swelling/shrinkage, cohesion, plasticity in soil. Soil Moisture movement-ground water, gravitational water, held water, soil suction.	08
4	Storm water Drainage: General principles subsoil Drainage. Compaction of soils, field and	08

	laboratory method of soil compaction, equipments used in field compaction.Design of surface and subsurface drainage system, pumping system, water body, holding ponds.	
5	Stress in soil: Theories of elastic and plastic behaviour of soils, Methods of reducing settlement, estimation of rate of settlement due to consolidation in foundation of road embankment,	04
6	Test on subgrade soils: Static and cyclic triaxial test on subgrade soils, resilient deformation, resilientstrain, resilient modulus. CBR test, effect of lateral confinement on CBR and E – value of Subgrade soil. Static and cyclic plate load test, estimation of modulus of subgrade reaction, correction for plate size, correction for worst moisture content.	06
7	Ground Improvement Technique: Different method of soil stabilization, use of geo-textile, geogrid and fibres, lime, fly ash in highway subgrade. Vertical sand drain: design criteria, construction and uses,	08

Term work:-
At least 10 assignments covering entire syllabus shall be submitted as term work.

Text Books:-

1. Principles of Pavement Design, Second edition, 1975: Yoder, E. J., John Wiley & Sons, Inc., New York
2. Concrete Roads: HMSO, Road Research Laboratory, London.
3. Highway Engineering: Khanna & Justo, New Chand & Brothers, Roorkee.
4. Principles and Practices of Highway Engineering: Dr. L. R. Kadiyali and Dr. N. B. Lal, Khanna Publication, New Delhi.

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE420	**Course :- Elective-I : Air Pollution**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

The students will learn to –

1. Quantify Composition of air and quantification of pollutional gases and particulates
2. Understand effects of air and noise pollution
3. Understand the plume behavior
4. Various incidences related to air pollution
5. Design of control devices such as fabric filters, cyclones, electrostatic precipitators

Course Outcomes:

The students will be able to

1. Design the various devices based on quantification and efficiency required
2. Quantify and analyse the data for air pollutants using stack sampling and ambient air sampling
3. Design a stack structure and zoning of nearby areas
4. Understand the various Government laws related to air pollution

Course Content

Module No	**Topics**	**No. of Lectures**
1	Composition of dry ambient air Properties of air. Function of air, Definition of pollution. Classification of air pollutants. Units for Qualification of air pollution History of air pollution, Global and national scope of the problem- general, urban, rural, specific.	05
2	Sources of air pollution natural and man made Major pollutants from different sources in Greater Bombay area (or any metropolis of Maharashtra), Emission factors.	05
3	Effects of air and noise pollution on human health, plants ,animals, properties and visibility, indoor air pollution and personal exposure to air pollution , simple numerical problems based on COH, CoHb	05
4	Meteorological aspects of air pollution Large scale wind circulation geotropic wind, gradient wind, cyclone, anticyclone, planetary boundary layer. Lapse rate, stability conditions, wind velocity profile, maximum mixing depth, topographic effects.	06
5	Plum patterns, plum dispersion, Gaussian model for predicting concentration, downwind from a single source, diffusion coefficients, Turner's stability categories and graphs for dispersion estimates. Maximum ground level concentration, inversion effects, distance touching ground	09

	modification of Gaussian model to predict particulate dispersion, plume rise, modified Holland equation for small source. ASME equation for large source, Brigg's equation for buoyant plum rise, Brigg's equation for momentum plum rise.	
6	Methods and instruments for sampling and analysis of air for stack and ambient air monitoring. Government of India: air pollution laws. Indian standards- emission and air quality standards.	07
7	Control Devices Principles, operations and types, simple hoods and ducts. Settling chambers, cyclones, electrostatic precipitators (ESP), Filters, scrubbers, absorption towers and incinerators. Collection efficiencies for laminar and turbulent flows for settling chambers, particle cut size for cyclone, ESP Concept of frictional and overall efficiencies. Design criteria for filters, scrubbers, absorption towers and incinerators.	10

Term work:-

Each student shall prepare a report on at least one of the following :

1) A stack monitoring report of at least one stacks describing the methods of sampling and analysis used.
2) An ambient air quality survey of a particular location.

At least 07 assignments, report as mentioned above shall be submitted as term work.

Text Books:-

1. Air Pollution: Henry Capeskins, McGraw Hill publication.
2. Air Pollution: Part A- Analysis and part B-Prevention and control: J.O. Ledbetter, Make Dekker Inc., New York.
3. Air Pollution: Wark and Warner, Harper & Row, New York.
4. Air Pollution Control Guidebook for Management: Edited by A.T. Rossano, Environ Science Service Division. ERA Inc., USA
5. Air Pollution Control Theory: Martin Crawford, Mc Graw hill publication.
6. Government of India's Publication of laws related to air pollution, Maharashtra Pollution Control Board's (MPCB) Publication of standards. Indian standards relevant to air pollution monitoring, definitions, standards.
7. Air Pollution: Rao M N & Rao H V N, Tata McGraw Hill Pub., New Delhi.
8. Air Pollution Vol.1: Tripathi A.K (editor) Ashish Publication House, New Delhi.
9. Air Pollution (Bio-pollutants in air): Srivastava A.K., Ashish Publication House, New Delhi.
10. Environmental Engineers Handbook Vol. II, Air pollution: B,G Liptak (ed) . Chilton Book Co .USA.
11. Air Pollution Handbook: PL Magill *et al.*, Mc Graw Hill publication.
12. Industrial Air Pollution Handbook: A Parker Tata McGraw Hills Publication.
13. Journal of Air and Waster Management Association (formerly known as journal of air pollution control association) Published from USA.
14. Air pollution, M N Rao, H V N Rao, Tata McGraw Hill.

Sr. No.	Examination	Module
1	T – I	1, 2, 3
2	T – II	4, 5
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE421	**Course :-Elective-I : Design of Prestressed Concrete Structures**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Content

Module No	**Topics**	**No. of Lectures**
1	Introduction to prestressed concrete: Basic concept and general principles, materials used and their properties, methods, techniques and systems of prestressing.	02
2	Analysis of prestressed concrete sections: Loading stages and computation of section properties, critical section under working load for pre tensioned and post tensioned members, stress method, load balancing method and internal resisting couple method, kern points, choice and efficiency of sections, cable profiles.	08
3	Loss of prestress: Loss of stresses doe to elastic deformation of concrete, creep in concrete, creep in steel, shrinkage in concrete, relaxation in steel, anchorage slip and friction.	05
4	Deflections of prestressed concrete members: Short time and long time deflection, deflection of uncracked sections, uni-linear and bi-linear methods for cracked sections.	04
5	Design of prestressed concrete sections for flexure in working stress and limit state method: General philosophy of design, permissible stresses in concrete and steel, suitability of section, safe cable zone, design of simply supported pretension and post tension slabs and beams using limit state method	10
6	Design for shear: Calculation of principle tension under working load, permissible principle tension, shear strength calculation under limit state of collapse for both sections cracked and uncracked in flexure.	05
7	End zone stresses in prestressed concrete members: Pretension transfer bond, transmission length, end block of post-tensioned members.	06
8	Introduction to application of prestressing to continuous beams and slabs, linear transformation and concordancy of cables.	08

Term work:-
At least 10 solved problems based on the above syllabus, one design report along with one half imperial size drawing sheet on design of a post-tensioned prestressed concrete beam (as a project) shall be submitted as term work.

Text Books:-

1. Prestressed Concrete: N. Krishna Raju, McGraw Hill, New York.
2. Prestressed Concrete: N. Rajgopalan, Narosa Publishing House.
3. Fundamentals of Prestressed Concrete: Sinha N.C & S.K. Roy, S.C. Chand & Company.
4. Prestressed Concrete Structures: Dayaratnam P, Oxford & mH
5. Design of Prestressed Concrete Structures: T.Y.Lin & N.H. Burns, John Willey, New York.
6. Design of Prestressed Concrete: Nilson Arthur, McGraw Hill Book Company.
7. Prestressed Concrete Vol-I: IY.Guyon, Contractors Record, London.
8. Prestressed Concrete: S. Ramamurtham, Dhanpat Rai & Son's
9. Relevant latest IS codes.

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VII**
CODE: CE422	**Course :-Elective-I : Traffic Engineering and Control**		
Prerequisites	**CE305, CE354**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In Semester	01	20*2
	End Semester	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To identify conventional and latest techniques of data collection for traffic surveys.
2. To describe application of statistical techniques for planning, design and operations of traffic regulatory, traffic flow and control devices.
3. To discuss the road safety norms and its efficient designs as per IRC guidelines.

Course Outcomes:

Students will be able

1. To implement the knowledge about latest techniques of data collection for traffic surveys and road safety norms.
2. To utilize the various statistical techniques for planning, design operations of traffic regulatory and control devices.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Traffic Engineering and control: Various traffic surveys and traffic studies: Speed, Journey time and Delay survey and studies, vehicle volume counts classification and occupancy, Origin – Destination surveys, Parking surveys.	08
2	Statistical methods for traffic engineering and their applications: Distributions, Sampling theory and Significance testing, Regression and Correlation.	07
3	Intersection Design: Principles, various available alternatives, rotary design, mini roundabout, Traffic signals: types of traffic signals, advantages, determination of optimal cycle time and signal setting for an intersection with fixed time signals, co-ordination of signals, types, area traffic control, delay at signalised intersection.	09

4	Accident and road safety: accident causes, recording system, analysis and preventive measures, accident cost, alternative methodologies for calculation.Traffic management: various measures and their scope, relative merits and demerits.	05
5	Highway capacity: passengers car units, level of service, factor affecting capacity and level of service, influence of mixed traffic, capacity and level of Sevice analysis.	05
6	Traffic signs and Markings : General principal of traffic signing, Types of traffic signs, Design of Signs, Location and maintenance of signs, Different types of road markings, marking design, marking maintenance Introduction to intelligent transportation systems.	06
7	Theory of traffic flow: Scope, definitions and basic relationship, review of flow density speed studies, hydrodynamic analogies, Application of hydrodynamic analogy, Lighthill and Whitham's theory, Car-following theory and its application to traffic engineering, probabilistic description of traffic flow, an introduction to queuing theory as applied to traffic flow problems for study state conditions, Fundamentals of traffic simulation modelling.	08

Term work:-

Project based on traffic studies- data collection and analysis, proposals for new facilities or improvement to existing facility / Application of traffic engineering software, at least 10 assignments covering entire syllabus shall be submitted as term work. Alternately a miniproject can be done involving data collection. analysis and design.

Text Books:-

1. Traffic Engineering and Transport Planning: L.R. Kadiyali, Khanna publishers Delhi
2. Principles of Traffic Engineering: G.J. Pingnataro, Mc Graw-Hill, 1970.
3. Traffic System Analysis for Engineering and Planners: Wohl and Martin, Mc Graw Hill, 1983.
4. Principles of Transportation Engineering: Partha Chakroborty and Animesh Das, Prentice hall (India)
5. Traffic Flow Theory and Control: Drew D.R., McGraw – Hill , New York, 1964
6. Highway Capacity Manual, Transportation Research Board, National Research Council, Washinton D.C.

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3,4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester-VII**
CODE: CE 423	**Course :- Elective-I: Reinforced Concrete Repairs and Maintenance**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Content

Module No	**Topics**	**No. of Lectures**
1	Introduction: Causes of deterioration of concrete structures. Effects of climate, moisture, temperature, chemicals, wear, erosion and loading on serviceability and durability. Design and construction errors. Causes of seepage and leakage in concrete structures. Formation of cracks including those due to corrosion.	6
2	Condition Survey, Evaluation and Assessment of Damage: Diagnostic methods and analysis. Destructive, Semi destructive and Non-Destructive methods including Core test, Carbonation test , Chloride test, Petrography, Corrosion Analysis, Cover meter test, Rebound Hammer test, Ultrasonic Pulse Velocity test, Crack measurement techniques, Concrete Endoscopy and Thermal imaging, Pull-off test and Pull-out test etc.	12
3	Materials and Methodology of Repairs: Repair analysis and design. Repair materials and their properties. Methodologies of crack and patch repair used of Polymer modified mortar, Polymer modified concrete, Polymer concrete. Injection grouting. Shortcreting. Joints and sealants. Rebar corrosion crack repair.	10
4	Protection of Concrete Structures: Protective materials and their properties for moisture barrier systems, Above-grade and below grade waterproofing of concrete structures. Systems like integral, crystalline, coatings, membranes etc,. Thermal protection coatings.	8
5	Rebar Corrosion Protection: Methods of Corrosion protection. Corrosion inhibitors, Corrosion resistant steels, Cathodic Protection, Pre-packaged zinc sacrificial anode, Snap-on zinc mesh anode CP system	8
6	Maintenance of concrete structures: Facets of maintenance. Planned preventive maintenance. Maintenance cycles. Statutory legislation and obligation.	4

List of Practicals:-(Minimum six experiments out of Sr. No 2 to 10)

1. Condition survey of any damaged structures by visual observation, crack measurement and preparing a report
2. Rapid chloride penetration test
3. Carbonation test by spraying phenolphthalein
4. Non destructive testing of concrete structures by Rebound hammer, UPV meter etc.
5. Corrosion analyzer by half-cell potential meter
6. Tests on polymer modified mortar/concrete and coating for adhesion by Pull-off test method
7. Outdoor exposure test to measure weathering of coating
8. Test for flexibility of coating by applying on a tin sheet
9. Test for effectiveness by measuring temperature difference of a thermal protection coating and concrete substrate on terrace
10. Test for effectiveness by measuring water absorption of coating applied on a card board

Term work:-

Report on condition survey and minimum six experiments performed shall be submitted as term work.

Text Books:-

1. Concrete Repair and Maintenance: Peter H .Emmons and Gajanan M. Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation-Compilation from Indian Concrete Journal-ACC Publication.
3. Guide to Concrete Repair and Protection, HB84-2006, A joint publication of Australia Concrete Repair Association, CSIRO and Standards Australia.
4. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG(Works), CPWD, Government of India (Nirman Bhawan), http://www.cpwd.gov.in/handbook.pdf
5. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center , http://books.google.co.in
6. Management of Deteriorating Concrete Structures: George Somerville, Taylor and Francis Publication
7. Concrete Building Pathology: Susan Macdonald, Blackwell Publishing.
8. Testing of Concrete in Structures: John H. Bungey, Stephen G. Millard & Michael G. Grantham, Taylor & Francis Publication.
9. Durability of concrete and cement composites: C.L.Page & M.M. Page,Woodhead Publishing

Class:- B. Tech. (Civil)			**Semester-VII**
CODE : CE405	**Course :- Project A**		
Periods per week (each of 60 minus)	Lecture	-	
	Practical	-	
	Tutorial	04	
		Hours	Marks
Scheme of Evaluation	Theory Examination	-	-
	Seminar	-	-
	Oral	-	-
	Term Work	-	50
	Total		**50 (Internal)**

A group of students is expected to take up a project from Civil Engineering field which is to be completed in Semester VII and Semester VIII.
The project work may include,

- experimental analysis / verification,
- development of design methods and verification,
- design and fabrication of a model for a civil engineering project,
- design for civil engineering structures and preparation of working drawings,
- developing a software for analysis and / or design of decision making in civil engineering and management practice
- technical and / or economic feasibility study
- study on new materials / methodology for construction

The students may be asked to work in groups with not more than four students in each group.

Basic study through review of literature on the topic selected shall be completed. The scope of the project, necessary data, sources of such data etc. shall be identified. The group of students has to prepare a brief report on the work done during the semester and is to be submitted. The report should at least include Introduction, Aim and objective of the project, scope of the project, methodology, review of literature and reference list. The group shall prepare and present a seminar based on this work.

Final Year B.Tech. Civil Engineering

Sem. VIII

Academic Scheme and Syllabus

Year 2015-16

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE451	**Course :-Design and drawing of Reinforced Concrete structures**		
Prerequisites	**CE356, CE401**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objective	• To develop Civil Engineering graduates having clear understanding of concepts, and practical knowledge of modern Civil Engineering techniques • To apply the structural analysis knowledge to design real life RCC structures for safety serviceability and economy. • To achieve effective communication, inculcate leadership and ethics to deal with social, environmental and economic issues.
Course Outcome	After completing the course student will be able to • To design buildings, water tanks, retaining wall for safety, stability and economy. • To prepare detailed drawings ready for construction. • To comply with regulations and requirements of RCC design as per relevant IS codes. • To act as catalyst in transferring the Civil Engineering knowledge to field usage for the socio-economic development of the society.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Design of retaining walls: (limit state method of design) Design of Cantilever, Counter fort type retaining wall.	08
2	Design of staircases: (limit state method of design) Design of Dog legged, Open well type staircase.	06
3	Design of Foundations: (limit state method of design) Design of simple raft subjected to symmetrical loading	08
4	Complete design of residential, commercial or Industrial building including staircase and foundations. (Limit state method of design).	07
5	Complete design of residential, commercial or Industrial building including staircase and foundations. (Limit state method of design). Overview of ductile detailing for Earthquake resistant structures.	05
6	Design of water tanks: Circular and rectangular, at ground level, underground and overhead water tanks	06
7	Design of water tanks: Circular and rectangular, at ground level, underground and overhead water tanks both by IS coefficient and - approximate methods, including supporting structure for overhead water tanks	08

Note: Relevant and latest IS codes of practice shall be followed for all the topics

Term work:-

Design report and at least four A1 (Full imperial) size drawings sheets for three projects covering the above syllabus shall be submitted as term work. All drawing work is to be done in pencil only. Exposure to design by available software for design is also to be considered.
The above mentioned work shall be submitted as term work.

Text Books:-

1. Ashok K. Jain(1993), "Reinforced Concrete: Limit State Design" , Nem Chand & Brothers, ISBN 8185240531, 844 pages
2. Dr. H. J .Shah,(2008),"Reinforced Concrete, Volume 2", Charotar Publishing House Pvt. Limited, ISBN 8185594732, 424 pages
3. S N Sinha, (2002),"Reinforced Concrete Design, Second Revised Edition", Tata McGraw-Hill Education, ISBN 0070473323, 705 pages
4. Karve & Shah, (2011), "Illustrated Design of Reinforced concrete Buildings", mihail-koprivchin-3758, 502 pages
5. Relevant I.S. codes and design aids
6. P.C. Vargese (2007) Advance reinforced concrete design, PHI Learning.
7. B.C. Punmia, Ashokumar Jain and Arunkumar Jain (2009), Limit State Design of Reinforce Concrete.

Reference books:-

1. B.P. Hughes (1976), "Limit State Theory for Reinforced Concrete Design", Pitman, ISBN 0273010239.
2. Phil Moss Ferguson, J.E. Breen & J.O. Jirsa (1988), "Reinforced Concrete Fundamentals", John Wiley and Sons (WIE), ISBN 0471803782, 592 pages.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE : CE452	**Course :- Quantity Survey, Estimation & Valuation**		
Prerequisites	**CE402, CE303, BTC206**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	04	100
	Practical	-	25
	Oral	-	--
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Quantity Survey:
A quantity survey involves the measurement and calculation of various quantities of material and labour required for a construction project. A quantity survey is typically done when all details, design, plans and drawings for the project are ready.

Estimation:
This deals with the estimation of quantities of material and labour along with the estimate for the cost of a project in the stages of its infancy. At this stage, no details are available or even if available; they are subject to major changes and revisions.

Valuation:
It is the art of evaluating the worth or utility of an asset. This is particularly of great interest in the real estate industry.

Course Objectives:

1. Explain various methods of detailed and approximate estimates.
2. Emphasize the importance of relevant IS codes and relevant Indian Standard Specifications, taking out quantities from the given requirements of the work, drafting specifications, conduct a material and labour survey and perform rate analysis for various items
3. Describe the process of tendering and its various stages
4. Assess the value of a property

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

1. Prepare approximate and detailed estimates based on the quantity survey of the available general and detailed drawings,
2. Draft specifications, make bar bending schedules, draw mass haul diagrams,
3. Draft tenders and prepare valid contract documents,
4. Assess the value of a property using the appropriate method using standard tables..

Course Content

Module No	Topics	No. of Lectures
1	Estimates: Various types, complete set of estimate. Different methods of approximate estimates. Use of CBRI Equations. Methods of preparation of estimates for projects such as i) Building R.C.C., Load bearing ii) Road iii) Sanitary works	14
2	Measurements for various items: Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams	06
3	Material survey: Approximate estimates of requirement of various materials for building works, percentage breakup of the cost, market survey of basic materials	05
4	Specifications: types, requirements and importance, detailing of specifications for various items	03
5	Rate analysis: purpose, importance and necessity of the same, factors affecting, task work.	06
6	Tender: preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. General and special conditions, termination of contracts, extra work and items, penalty and liquidated charges, Settlement of disputes, etc.	06
7	Valuation: different terms used, the role of a valuer, purpose and necessity of the same. Capitalised Value, Years purchase, sinking fund, depreciation, types of values, Purpose of valuation. Different methods of valuation for i. open plots. ii. open plots with existing residential & commercial structures iii. lease hold properties Use of valuation tables and formulae	08

Term work:-

The term work shall consist of the following:

i. To find out the approximate estimate of a multistoried building by approximate method.
ii. Detailed estimate of any TWO of the following with the required material survey for the same.
   a. a ground plus three storied building (RCC)
   b. a bridge with minimum 2 spans
   c. a road work
   d. a cross drainage work
   e. a load bearing structure
iii. Preparation of valuation report in standard Government form.
iv. Assignments on rate analysis, market survey, specifications and simple estimates.
v. Bar bending schedule

Use of quantity survey software and for some of the above assignments is desirable.
Total of minimum ten assignments including all of the above.

Text Books:-

1. M Chakraborty (2006); "Estimating, Costing Specifications & Valuation" M Chakraborty Kolkata. ISBN-13: 978-8185304366.
2. B.N. Dutta. "Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuation" Sangam Books. ISBN -13 9788174763839. 917p
3. B.S. Patil (2006); "Building & Engineering Contracts", Universities Press (India) Pvt. Limited, ISBN 13 :9788173715594. 516p.
4. A.K. Upadhyay (2013); "Civil Estimating & Costing: Including Quality Surveying, Tendering and Valuation" S K Kataria and Sons. ISBN-13: 978-8185749983. 474p
5. Relevant Indian Standard Specifications, BIS Publications
6. World Bank approved contract documents

Sr. No.	Examination	Module
1	T – I	1 , 2
2	T – II	3,4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE 453	**Course :- Construction Management**		
Prerequisites	**BTC206, CE306**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Construction Management

Construction management is the branch of engineering which provides information regarding management of Civil Engineering Projects in addition to safety, quality etc.

Course Objectives:

1. To describe to the students about the unique features of construction project and subsequent legal aspects for labours.
2. To summarize the students about various techniques of construction planning, resource scheduling, project monitoring quality control and safety of personnel involved.

Course Outcomes:

1. Plan the project right from initial stage up to completion stage.
2. Use quality and safety tools to all personnel for smooth completion of construction work.
3. Carry out dispute free construction work.

Course Content

Module No	**Topics**	**No.of Lectures**
1	Construction: Unique features of construction, construction project, types and features, phases of a project, agencies involved and their methods of execution.	03
2	Construction project planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data	07
3	Techniques of planning: Bar charts, Networks: basic terminology, single and overlapping relationships preparation of CPM networks: activity on link and activity on node representation, analysis of single relationship (finish to start) networks, computation of float values, critical and semi-critical paths, calendering networks. PERT: Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.	16

4	Resource Scheduling: Line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling	05
5	Planning and organizing construction site and resources: Site: site layout, developing site organization, record keeping at site, Manpower: planning, organizing, staffing, motivation, Materials: concepts of planning, procurement and inventory control, Equipment: basic concepts of planning and organizing, Funds: cash flow, sources of funds. Construction costs: Classification of costs, time cost trade-off in construction projects, compression and decompression	10
6	Monitoring & control: Supervision, record keeping, periodic progress reports, periodical progress meetings Updating of plans: purpose, frequency and methods of updating Common causes of time and cost overruns and corrective measures Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control Safety and health on project sites: accidents; their causes and effects, costs of accidents, occupational health problems in construction, organizing for safety and health	04
7	Purpose and brief provisions in brief of following acts: Minimum wages act, The building and other construction workers (regulation of employment and conditions of service) Act, The building and other construction workers welfare cess Act, Contract Act, Alternative disputes resolution methods	03

Term work:-
At least 10 assignments including numerical problems shall be submitted as term work.

Text Books:-

1. Barrie D.S. & Paulson B C (2013); "Professional Construction Management" McGraw Hill Education (India) Private Limited. ISBN-13: 978-1259098420. 672p.
2. Chitkara K K (2010); "Construction Project Management" McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070680753. 772p.
3. P K Joy (1991); "Handbook of Construction Management", Macmillan, India. ISBN-13-9780333926932. 484p
4. King & Hudson (1985); "Construction Hazard and Safety Handbook", Butterworths. ISBN-13: 978-0408013475. 477p.
5. Antill J M & Woodhead R W, (1990); "Critical Path Methods in Construction Practice:" John Wiley & Sons. ISBN-13: 978-0471620570. 448p
6. S.Seetaraman (2000); "Construction Engineering and Management". Umesh pub. ISBN-13 9788188114061. 487p
7. L.S.Shreenath (2001); "CPM and PERT" Affiliated East-West Press (Pvt.) Ltd. ISBN-13: 978-8185336206
8. Dr.B.C.Punmia (2010); "CPM and PERT" Motilal UK Books of India. ISBN-13: 978-

8131806982. 250p.
9. Indian Contract act.

Sr. No.	Examination	Module
1	T – I	1,2
2	T – II	3,4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester-VIII**
CODE: CE454	**Course :- Project B**		
Periods per week (each of 60 minutes)	Lecture	-	
	Practical	-	
	Tutorial	04	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Seminar	-	-
	Presentation and Oral	-	50
	Term Work	-	50 (internal)
	Total		**100**

In continuation to semester VII work, the group of the students shall collect all necessary information pertaining to the project and analyse it. The group of the students shall prepare and submit a detailed report on the project.

The report shall be typewritten on A4 size papers and hard bound as per prescribed norms. Broadly the report shall include: Introduction, Literature Review, Problem definition, Data collection and analysis, Results (Numerical / Experimental), Conclusions and discussions.

Acquaintance with survey and research methods and their use in conducting systematic investigations, use of data analysis tools, computational methods and style of report, preparation and presentation shall form basis of evaluation. The group shall prepare and present a seminar based on this work before an external examiner.

Class:- B. Tech. (Civil)			**Semester VIII**
CODE : CE456	**Course :-Elective-II – Industrial Waste Treatment**		
Prerequisites	**CE355, CE404**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives

The students will learn to –

1. Analyse and understand the difference between Industrial and municipal waste and wastewater
2. Predict DO levels using Streter Phelps modeling
3. Utilize advanced treatment techniques
4. Design treatment schemes for industries such as pulp and paper, textile, tannery, dairy, electroplating, cane sugar and distilleries
5. Emphasize on Inplant control and good housekeeping

Course Outcomes

The students will be able to

1. Design various units for treatment based on initial characterization
2. Analyse and prepare solution based on various types of impurities present before disposal of waste
3. Predict DO at various stages in a river and suggest changes in the present industries
4. Utilize and administer environmental law as a restrictive measure for pollution

Course Content

Module No	**Topics**	**No. of Lectures**
1	General: liquid wastes from industries – their volumes and characteristics, Effect of disposal into natural water courses, Municipal sewers and on land, River standards and effluent standards	06
2	Sampling and analysis of industrial wastes, Treatability study	06
3	Stream sanitation: Effects of industrial wastes on self-purification of streams and fish life, Statement and significance of the parameters of Streeter and Phelp's equation and BOD equations, deoxygenation and reaeration , Oxygen sag	06
4	General treatment of industrial wastes: neutralization, equalization, segregation.	02
5	Modification of conventional aerobic and anaerobic biological treatment methods. Dewatering and disposal of sludges – floatation, vacuum filtration, centrifugation, filter press, Inplant control measures for volume and strength reduction	06
6	Detailed consideration of wastes produced from following industries:	14

	Processes normally followed Volume and effects of raw and treated effluent on streams, sewers and land. Treatment methods , reuse-recovery 1) Textiles: cotton and synthetic 2) Pulp & paper:- Sulphate process 3) Electroplating 4) Dairy 5) Sugar- sugarcane 6) Distilleries 7) Tanneries	
7	Provision of various acts pertaining to industrial wastes / effluents, introduction to environmental impact assessment and environmental audit.	08

Term work:-
Each student shall prepare a report comprising design criteria and flow sheet of the proposed treatment scheme including laboratory analysis for any one industrial waste. Demonstration of available software for design of effluent treatment plant is to be considered.
The report mentioned above, at least 5 assignments shall be submitted as term work.

Text Books:-

1. Waste Water Treatment: Rao & Datta, Oxford & IBH Publishing Co.
2. Industrial Water Pollution Control: W W Eckenfelder Jr, Mc Graw Hill
3. Industrial Water Pollution Management: E F Gurnham, John Wiley
4. Biological Waste Treatment: Eckenfelder & Connor Pergamon Press
5. Theories and Practices of Industrial Waste Treatement: Addisoon Wesley
6. Pollution Control in Process Industries: S P Mahajan , Tata mcgraw Hill
7. Industrial Waste: W Rudolfs ,(Ed), L E C Publishers Inc
8. The Treatment of Industrial Wastes: E D Besselievre Mcgraw Hill
9. Industrial Waste Disposal: R D Ross , (Ed), Reinhld Bok Croporation

Sr. No.	Examination	Module
1	T – I	1, 2, 3
2	T – II	4, 5,6 (2 industries)
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE : CE457	**Course :-Elective-II : Earthquake Engineering**		
Prerequisites	**BT201, BTC201**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

- To develop civil engineering graduates having clear understanding of concept of dynamic loads, dynamic analysis, basic section analysis & section analysis of structures.
- To apply the knowledge of structural dynamic to evaluate the seismic response of structural subjects to different ground motion. To apply response spectrum concept to characterize the ground motion.
- To apply provisions of IS 1893-2002 & IS 13920 to design seismic resistant structures.
- To inculcate ethics to deal with social, environmental & economic issues.

Course Outcomes:

After completing the course students will be able to:

- Evaluate dynamic loads,carry out dynamic analysis & understand basic seismology.
- Evaluate the seismic response of various structures subjected to different ground motions.
- Design earthquake resistant structures using the provision of IS -1893-2002 & IS 13920.

Course Content

Module No	Topics	No. of Lectures
1	**Introduction:** Introduction to structural dynamics, definition of basic problem in dynamics, static v/s dynamic loads, different types of dynamic loads.	2
2	**Single degree of Freedom (SDOF) systems:** Undamped vibration of SDOF system, natural frequency and period of vibration, damping in structures, viscous damping and coulomb damping, effect of damping on frequency of vibration and amplitude of vibration, logarithmic decrement. Forced vibration, response to harmonic forces, periodic loading, dynamic load factors, response of structure subjected to general dynamic load, Duhamel's integral, numerical evaluation of dynamics response of SDOF systems subjected to different types of dynamic loads. Use of Fourier Series for periodic forces, introduction to vibration isolation.	10

3	**MDOF systems:** Direct determination of frequencies and mode shapes, orthogonality principle, approximate methods for determination of frequencies and mode shapes. Forced vibration of MDOF system, modal analysis, applications to beams and multistoried frames with rigid girders subject to lateral dynamic loads including ground motion.	08
4	**Seismological background:** Seismicity of a region, earthquake faults and waves, structure of earth, plate tectonics, elastic-rebound theory of earthquake, intensity and magnitude of earthquake, measurement of ground motion, seismogram, earthquake frequency, local site effects, seismotectonics and Seismicity of India.	06
5	**Characterization of ground motion:** Earthquake response spectra, factors influencing response spectra, design response spectra for elastic systems, peak ground acceleration, response spectrum shapes, deformation, pseudo-velocity, pseudo-acceleration response spectra. peak structural response from the response spectrum, response spectrum characteristics, construction site specific response spectra.	06
6	**Deterministic earthquake response:** Types of earthquake excitation, lumped SDOF elastic systems. translational excitation, lumped MDOF elastic systems, translational excitation, time history analysis, multistoried buildings with symmetric plans, multi storied buildings with un symmetric plans, torsional response of symmetric plan building, distributed - parameter elastic systems, translational excitation, combining maximum modal responses using mean square response of a single mode, SRSS and CQC combination of modal responses.	06
7	**I. S. code method of seismic analysis:** Seismic co-efficient method and its limitation, response spectrum method, IS 1893-2002 provisions for seismic analysis of buildings and water towers, seismic evaluation and retrofitting, types of structural system used in building to resist earthquake loads. Review of damages during past earthquakes and remedial measures, seismic design considerations, allowable ductility demand, ductility capacity, reinforcement detailing for members and joints as per IS 13920	06 04

Term work:-
At least 20 (twenty) solved problems based on the above syllabus shall be submitted as term work. Exposure to computer aided analysis using available software be considered.

Text Books:-

1. Dynamics of Structures by Anil K Chopra, Prentice Hall of India
2. Structural Dynamics of Earthquake Engineering: Theory & Application using MATHEMATICA & MATLAB by S Rajasekaran, Woodhead Publishing Ltd.
3. Earthquake Resistance Design & Risk Reduction by David Dowrick, Wiley India
4. Seismic Analysis of Structures by T K Dutta, John Wiley & Sons (Asia) Pvt.Ltd
5. I.S. Codes No. 1893, 4326, 13920 (All latest codes)

Reference Books:-

1. Fundamentals of Earthquake Engineering by N M Newmarks & E Rosenblueth, Prentice Hall
2. Earthquake Spectra & Design by N M Newmarks & W J Hall, Earthquake Engineering Research Institute, Berkeley, California
3. Dynamics of Structures by Clough & Penzien, McGraw-Hill, Computers & Structures
4. Fundamentals of Earthquake Engineering by Amr S Elnashai & Luigi Di Sarno, Wiley India
5. Fundamentals of Earthquake Resistant Construction by Ellis L Krinitzsky, James P Gould & Peter H Edinger, Wiley India
6. Elementary Seismology by C R Richter, W.H. Freeman & Company, San Francisco
7. Design of Earthquake Resistant Structures by E Rosenblueth, Pentech Press, London
8. Design of Seismic Isolated Structures: From Theory to Practice by Farzad Naeim & James M Kelly, John Wiley & Son
9. Mechanics of Rubber Bearings for Seismic and Vibration Isolation by James M Kelly & Dimitrios A Konstantinidis, Wiley
10. Seismic Engineering by Jacques Betbeder-Matibet, Wiley
11. Seismic Design of Reinforced Concrete & Masonary Buildings by T. Paulay & M J N Priestley, Wiley India
12. Plate Tectonics: An Insider's History of The Modern Theory of The Earth by Naomi Oreskes, Westview Press
13. "Proceedings on World Conference on Earthquake Engineering" 1956-2000.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE458	**Course :-Elective-II : Pavement Design and construction**		
Prerequisites	**CE305, CE354**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To explain the distribution of stress within the pavement and methods available for design of flexible and rigid pavement.
2. To discuss the methods of strengthening existing pavements.
3. To describe the mechanistic Approach in flexible pavement design.
4. To summarize importance of low cost and other types of road, it's methods of construction.

Course Outcome:
The students will be able

1. To identify distribution of stresses within pavements and its design by IRC approach, AASHTO method and Asphalt Institute method.
2. To implement the knowledge of Benkelmen Beam study for overlay design.
3. To execute the knowledge of finite element software such as ANSYS for mechanistic approach in pavement design.
4. To carry out the construction of low cost and other types of road.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Pavement structure and functional attributes, factor affecting pavement design, types of wheel loads for highways and airports, development of design method for highway and airport pavements. Stresses in flexible pavements, 1-layer, 2-layer, 3-layers theories, EWLF, ESWL, Stresses in Rigid pavement: load and temperature stresses, combined stresses.	06
2	Flexible Pavement Design Airport pavement: Corps of Engineer's method, FAA method CDOT method, Asphalt institute method. Highway Pavement: Empirical methods using no soil strength criteria, empirical method based on soil strength criteria: CBR method as specified by IRC, Road note 29 methods, AASHTO method, Asphalt institute	08

	method. Fatigue and rutting as a failure criterion.	
3	Rigid Pavement Design: Airport pavements: PCA methods, corps of Engineer's method, FAA method.Joints and reinforcement requirement.Highway pavement: IRC method.	06
4	Evaluation and strengthening: flexible and rigid pavement distresses, condition and evaluation surveys, present serviceability index, roughness measurement, Benkaleman beam deflections, design of overlays, skid resistance and measurement.	06
5	Concrete road construction: Mix design, concrete strength, size of aggregates, and gradation, and workability, preparation of base form work, placing of reinforcement, compaction, and finishing, curing, joints.	04
6	Importance of Mechanistic approach in flexible pavement design, use of finite element method in pavement design, design of pavement using rutting equation, fatigue criteria,	08
7	Low Cost Raods (Rural Areas) Classification of low cost roads, construction of low cost roads, stabilization of subgrade, base and its adventages, construction of granular base courses, macadam surface, macadam bases, low cost materials and methods used for highway construction, suitability of different types of roads under different situation. Soils.	07

Term work:-
At least 10 assignments shall be submitted as term work.

Text Books:-
1. Principles and Practice of Highway Engineering: L.R.Kadiyali, Khanna publications.
2. Highway Engineering: Khanna S.K. and Justo C.E.G. Nem Chand.
3. The design and Performance of Road Pavements: Croney, David et al, McGraw Hill.
4. Pavement Design: Yoder and Witzech, McGraw-Hill, 1982.
5. Pavement Analysis and Design: Yang H. Huang, Prentice Hall, New Jersey, 1993

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE459	**Course :-Elective-II :Water Resources Engineering and Management**		
Prerequisites	**CE304, CE353**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In Semester	01	20 x 02
	End Semester*	03	100
	Practical/MCQ	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**
*60% Weightage for end semester			

Course Objectives:

1. To Describe objectives of Water resources project planning, investigations and data requirement.
2. To discuss Water resources system design, development, assessment and environment impact assessment.
3. To explain Engineering economy in flood control projects.
4. To summarize the different techniques of watershed modelling.
5. To identify requirements of multipurpose project developmental issues.

Course Outcomes:

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

1. To carry out Investigations required in water resources project planning, formulation evaluation and its economics.
2. To Estimate flood, its control measures, flood forecasting techniques, warning system and its benefits.
3. To formulate the hydrological Model for watershed by different techniques along with applications of optimization techniques for water resources projects.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Water resources project planning: Investigations in project planning, planning data requirement and collection, levels of planning and objectives, project formulation and evaluation, multipurpose project planning, Drawbacks in planning, system approach in water resources planning.	08
2	Water resources development: Objects of water resources development, Water resources system design, Water resources assessment, augmentation of water resources, Economics of water resources development, Integrated and conjunctive use of water development, Irrigation and water management, Constraints in irrigation development, National water policy.	10
3	Water resourcesenvironment: Environmental planning for water resources projects, environmental impact assessment for water resources projects, measurement of EI, status of EIA in India.	06

4	Engineering economy in flood control projects: Flood estimation and flood control measures, flood forecasting and warning, effect of urbanization on runoff, peak flow methods in urban area, Flood routing through reservoirs and channels, discounting formulae, discounting methods, economics of flood control, estimating flood damages, estimating flood control benefits, reservoir sedimentation and control.	10
5	Modelling watershed hydrology: Hydrologic processes, rainfall-runoff measurement and analysis, Hydrographs and IUH, Mathematical models in hydrology, Nash and Clark model, Generalized watershed simulation models, GIS tool in watershed management, probability and stochastic models, frequency analysis, Regression and correlation.	10
6	Applications of optimization techniques: Optimization techniques for water resources projects by linear programming, non-linear programming and dynamic programming, mathematical models for large scale multipurpose projects, different case studies.	08
7	Multipurpose developmental issues: hydro-electric power development and power sector, inland water transportation, micro-level planning, watershed management, rainwater harvesting, cloud seeding, cost-benefit considerations in water resources planning, River basin management.	08

Term work:-
Minimum 10 assignments covering entire syllabus shall be submitted as term work.

Text Books:-

1. Water Resources Engineering: Ralph A Wurbs, Weseley P James, Prentice Hall, India
2. Economics of Water Resources Planning: L D James, R R Leo, MC Graw Hill
3. Elements of Water Resources Engineering: K N Duggal &J P Soni, New Age International Publishers
4. Environmental Impact Assessment: Larry W Canter, MC Graw Hill, 1997
5. Introduction to Hydrology: Warren Viessman,Jr. & Gary L Lewis, Pearson Education, 2007
6. Hydrology- Principles, Analysis, Design: H.M.Raghunath, New Age International Publishers

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE : CE460	**Course :-Elective-II : Advanced Engineering Geology**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To discuss the behavior of highly variable earth materials such as rock, soil, water on the earth's surface and their application in engineering planning and development.
2. To describe the formation of soil, rock, fault distribution and bedrock properties of an area to determine their engineering properties and their interaction with the proposed construction.
3. To discuss the agents modifying the earth's surface like earthquakes and the preventive measures undertaken for structures constructed in earthquake prone areas.
4. To explain the importance and methods of surface and sub-surface investigations and geological considerations while selecting sites and construction for dams, reservoirs, tunnels, bridges, etc.

Course Outcomes:

After successful completion of this course the students will be able

1. To carry out critical analysis and have an advanced knowledge of the application of geological processes to civil engineering design.
2. To conduct proper geological and geotechnical investigations for major civil engineering projects.
3. To examine and give opinions regarding the geological hazards, erosion, dewatering, seismic investigations and its impact on structures, etc.
4. To estimate the safety of slopes, foundations, for construction of tunnels, dams and design suitable remediation measures to mitigate problems and ensure safety under service conditions.

Course Content

Module No	**Topics**	**No. of Lectures**
1	**Introduction** Importance of geological studies in engineering investigations, precautions to avoid misleading conclusions likely to be drawn while interpreting drilling data with particular reference to RQD, case studies illustrating economics made possible by proper geological studies. **Earthquakes** Terminology, Classification, Causes, Effects, Recording of an Earthquake, Location of Epicenter, Earthquake problems in India.	09
2	**Engineering Geology of Deccan trap basalts.** Factors affecting strength and water tightness, stability of cuts and ability to stand without support, significance of features like gas cavities, jointing,	08

	weathering, hydrothermal alteration, volcanic breccias, tachylytes, dykes, fractures, field structures of flows, stratigraphic sequence of flows etc. and their significance in civil engineering projects. **Construction material** Deccan trap basalts and sedimentary rocks as construction Material.Use of compact basalt and amygdaloidal basalt as Rubble for masonary metal for concrete making.	
3	**Geophysical Investigations** Seismic and electrical resistivity methods of explorations **Role of geology in planning and development** Influence of geological factors upon urban development & planning ,locating nonrenewableresources and geothermal energy	06
4	**Dams** Strength and water tightness of deccan trap rocks from foundation point of view, physical properties such as compressive strength, water absorption etc. of basalts, effect of weathering and hydrothermal alteration on engineering properties of rocks, deterioration of rock masses on exposure to atmosphere and suitable treatment for such rocks. Investigations for determining the foundation treatment for adverse geological features, determination of foundation levels/cutoff levels for dams, groutability of rocks, correction of adverse feature by grouting, purpose of consolidated and curtain grouting, determining depth and zones of grouting, relation of zones of grouting with height of dams, foundation treatment for fractures having different manifestations, jointed rocks, tachylytes and dykes. Erosion of tail channel as a factor in selecting site for spillway causes of rapid erosion from side spillways, geological conditions leading to erosion. Case histories	08
5	**Tunneling** Methodologies of investigations for different types of tunnels for different purposes, location spacing ,angles &depths of drill holes for different types of tunnels, difference in behaviour of basalts because of jointing as exemplified by compact basalts & amygdaloidal basalts. Diffulties introduced by tachylytes, volcanic breccias, tuffs, intertrappean beds, fractures, dykes, hydrothermal alteration, and flow contacts unfavourable field characters. Computing structural discontinuities in rock masses, RQD, joint frequency index. RMR values, Q system, standup time. Selection & provision of protective measures such as guniting, rock bolting, shotcreting, steel supports depending on geological conditions. Suitability of TBM for tunneling.Case histories of India	04
6	**Bridges** Investigations for bridge foundations, computing SBC for bridge foundation based on nature & structure of rock, foundation settlements. Case histories	05
7	**Geology of soil formation** Residual & transported soils. Rock weathering conditions favourable for decomposition & disintegration, influence of climate on residual & transported soils in the deccan trap area. Nature of alluvium of deccan traps rivers & its engineering character. Effect of deposition of calcium carbonate. Scarcity of sand in the rivers in deccan trap area.	06

List of Practicals

1. Logging of drill core, preparation of litho logs and interpreting drilling data, calculation of RQD and joint frequency index. Preparing geological cross sections from drill hole data and using them for designing of civil engineering structures.
2. Use of electrical resistivity method for determining depth of bed rock.
3. Study of geological aspects of an engineering projects and writing a report based on studies carried out during visit to civil engineering projects.

Term work:-

Reports on experiments performed as detailed above shall be submitted as term work.

- A compulsory guided tour to study geological aspects of an engineering projects & writing a report based on studies carried out during visits to civil engineering projects.

Text Books:-

1. PWD Hand Book, Engineering Geology, Government of Maharashtra
2. Text Book of Engineering Geology: R.B.Gupte, PVC Prakashan
3. Geology of India: D.H.Wadia, McGraw Hill, New Delhi.
4. Geology of India and Burma: M,S,Krishnan, CBS Publications
5. Engineering and General Geology: Parbin Singh, Kataria S. K., New Delhi
6. Test book of Engineering Geology: N.Chenna.Kesavulu
7. Principles of Geomorphology: Thornbury,W.D
8. Earthquake Geography and Management: Srivastav,H,N

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3,4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE461	**Course :-Elective-II : Rock Mechanics**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To describe the engineering characteristics of rock masses and their use in construction.
2. To classify rock and rock massess based on RMR, Geo-Engineering classification, Deere and Miller's Engineering Classification and other such factors.
3. To discuss the stress distribution in rocks based on field and laboratory test and the response of rocks with respect to compressive strength, strength due to induce anisotropy and stress – strength models.
4. To estimate the bearing capacity of rock and discuss the factors affecting the stability of rock slopes.
5. To discuss the processes involved in rock bolting, grouting, anchoring, tunneling and their application in engineering construction.

Course Oucomes:

At the end of this course the students will be able

1. To classify rocks based on various classification methods and predict the behavior of rock mass under the application of loads.
2. To estimate the stability of rocks slopes and determine the bearing capacity of rocks on which structures are to be constructed.
3. To predict the proper construction techniques to be undertaken such as the various type of rock bolting, grouting, anchoring, tunneling, depending on the properties of rock

Course Content

Module No	**Topics**	**No. of Lectures**
1	Structural geology of rocks, subsurface investigations in rocks and engineering characteristics of rock masses	08
2	Engineering Classification of Rocks and Rock Masses:Classification of intact rocks, rock mass classifications {rock quality designation, rock structural rating, geomechanics classification (RMR)}, strength and modulus from classifications, classification based on strength and modulus, geo-engineering classification, Deere and Miller's Engineering Classification.	05
3	Stress Distribution in Rocks:Field and Laboratory Tests on Rocks	05
4	Strength, Modulus and Stress-Strain Responses of Rocks:Factors influencing rock responses, strength criteria for isotropic intact rocks, modulus of isotropic intact rocks with confining pressure, uni-axial compressive strength of intact anisotropic rocks, strength due to induced anisotropy in rocks, compressive strength and modulus from SPT, stress-strain models (constitutive models, elastic stress-strain model, elasto-plastic	06

	stress-strain model, equivalent material concept), influence of intermediate principal stress.	
5	Bearing Capacity of Rocks:Estimation of bearing capacity (foundation on intact rock, heavily fractured rock, UBC with Hoek-Brown criterion, foundation on slope), stress distribution in rocks, factor of safety, strengthening measures (concrete shear keys, bored concrete piles, tensioned cable anchors, concrete block at toe), settlement in rocks (from joint factor, for horizontal joints, from field tests).	06
6	Stability of Rock Slopes:Modes of failure, rotational failure, plane failure, wedge method of analysis, buckling failure, toppling failure, improvement of slope stability and protection.	06
7	Opening in Rocks, Rock Bolting and Grouting Introduction to theory of elasticity, lines and unlined tunnels, pressure tunnels and tunnels for other purposes.Grouting in rocks, objectives, contact grouting, consolidation grouting, process of grouting, grout requirement, types of grout, stage grouting, grout curtain.Rock bolts, rock bolt types and applications, theory of rock bolting, rock anchors, modes of failure, uplift capacity.	12

List **of Practicals**
Practicals include confined and unconfined compression test, point load test, Brazilian tensile test, permeability test and modulus of elasticity of rocks.

Term work:-
Each student shall prepare a report on experiments conducted and a project report covering the selection of design parameters, design analysis including drawing on any aspect of rock mechanics included in the syllabus.
The project report referred above, at least five examples report on experiments shall be submitted as term work.

Text Books:-

1. Fundamentals of Rock Mechanics: J. C. Jaeger and N. G. W. Cook, Oxford Press.
2. Rock Mechanics and Design of Structures on Rock: Obert, Leon and W. I. Duvall
3. Rock Mechanics in Engineering Practice: K. G. Stagg and O. C. Zienkiewicz, John Willey & Sons, New York.
4. Rock Mechanics - Vol. I & II: Jumukis, Trans Tech Publication, USA.

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3,4,5
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE462	**Course :- Elective-II : Geographic Information System**		
Prerequisites	**CE411**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

A surveyor enjoys diverse responsibilities as part of his or her everyday routine. Surveying technicians primarily work outside collecting data and establishing control points and boundaries. Others work inside an engineering office helping in site design activities and developing plans from the field data.

Course Objectives:

The students will learn:

1. About various softwares and their utility for geographical information systems (GIS), Digital elevation modeling, etc.
2. Demonstrate and use state-of-the-art computer softwares in conjunction with the fundamentals of civil and site design.

Course Outcome:

The students will be able to

1. Demonstrate an appropriate mastery of fundamental knowledge and software of GIS, DEM, and other technological processes inherent to their specific field of study.
2. Apply fundamental knowledge along with GIS technology and skills to conduct small projects.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Introduction to GIS: Definition, sources of data, types of data, concept of space and time in GIS, spatial information theory, history of GIS, elements of GIS, objectives of GIS, hardware and software requirements of GIS, application of GIS	06
2	Data models of spatial information: Layers and coverage, conceptual models of spatial information, representation of spatial data models in computer: raster and vector models, comparative overview between raster and vector models	10
3	Data models of non-spatial information: Database management systems, hierarchical structure, network structure, relational structure	06
4	Digitizing, Editing and Structuring of map data: Digitizing: manual, semi-automatic and automatic, editing: error detection and correction, tolerances, topology creation, attribute map generation	10

5	Digital Elevation Model: Need of DEM, Various structures of DEM: line, TIN, grid.	08
6	Integration of GIS, GPS & RS: Integrated systems, its advantages, development of integrated systems.	04
7	Applications: Forest resource management, agriculture and soil management, water resource management, land use and land suitability, disaster management	04

List of Practicals:

At least TEN practicals shall be performed from the list given below.

1. Installation of GIS software and getting familiarized with GIS menu and Tools.
2. Map Projections and Map digitization.
3. Georeferencing.
4. Creating Vector and Creating Raster data / data layers.
5. Creating attribute table.
6. Measurements; length and area.
7. Data viewing based on Single Symbol, Graduated Symbol.
8. Data viewing on Continuous color and unique value.
9. Labeling the features.
10. Selection tool and Geo-processing tool (Buffer, Clip, intersect and difference).
11. Coordinate capture – to save in notepad.
12. Joining layers based on common field.
13. Data conversion (raster to vector), polygon to polyline.
14. Add Graphic overlay to a vector layer.
15. Import and export data and Map Layout.

Term work:-

Report on practicals conducted, at least 5 assignments shall be submitted as term work.

Text Books:-

1. Geographic Information Systems and Science, Second Edition 2005: Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind, John Wiley & Sons, New York.
2. Modeling Our World: The ESRI Guide to Geodatabase Design: Zeiler, M. 1999. ESRI Press, Redlands, California
3. GIS, Spatial Analysis and Modeling: Maguire, D., M. Batty, and M. Goodchild. 2005, ESRI Press.
4. Introduction to geographic Information Systems: Kang-tsung Chang, Tata mcgraw Hill.
5. Advanced Surveying (Total Station, GIS and Remote Sensing) First Edition 2007: SatheeshGopi, R. Sathikumar, N. Madhu,

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE463	**Course :-Elective-II : Environmental Impact Assessment & Audit**		
Prerequisites	**CE355, CE404**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical/ MCQ	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

The students will learn to -

1. Utilize EIA for various projects
2. Monitor the data
3. Design mitigation plans
4. Environmental Auditing process
5. Deliberate on Laws related to EIA and Auditing in India

Course Outcomes -

The students will be able to

1. Evaluate the need to EIA
2. Demonstrate an EIA procedure for a project
3. Understand the laws and where they can be applied in Indian Context

Course Content

Module No	**Topics**	**No. of Lectures**
1	Environmental impact assessment What is it, Environmental attitudes, Brief history of EIA, Significance of EIA, Role of EIA in planning & decision making process, objectives of EIA.	06
2	Environmental assessment process Assessment methodology , Socioeconomic impact assessment, Air quality impact analysis, Noise impact analysis, Energy impact analysis, Water quality impact analysis, Vegetation & wild life impact analysis, Cumulative impact assessment, Ecological impact assessment, Risk assessment.	12
3	Environmental Impact Assessment Basic concept behind EIS, Stages in EIS production: Screening, scoping, prediction, evaluation, reducing impact, monitoring, conclusions, typical EIS outline,	06
4	Rapid EIA	06
5	Environmental Auditing Definition, aims & objectives, audit principles, incentives to undertake audit, partial environmental audits, stages of implementing environmental audits, scope of audit	06

6	Provisions of various environmental acts of India	06
7	Case Studies	06

Term work:-
At least 10 assignments shall be submitted as term work.

Text Books:-

1. Corporate Environmental Management: Welford R, University Press
2. Environmental Assessment: Jain R K, McGraw Hill
3. Environmental Impact Assessment: Harry W Conter, McGraw Hill
4. Environmental Impact Assessment – Handbook: John G Rau & D C Wooren, McGraw Hill.

Sr. No.	Examination	Module
1	T – I	1, 2,3
2	T – II	4,5
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE464	**Course :-Elective-II : Appraisal and Implementation of Infrastructure Projects**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objective:

1. To discuss about construction project and their appraisal.
2. To explain market and management appraisal of construction project.
3. To describe the need of financial and environmental analysis.
4. To outline project financing and its implementation.

Course Outcome:

1. To carry out construction project appraisal.
2. To evaluate construction economic and environmental analysis.
3. To practice various method for implementation of construction project including arrangement of finance.

Course Content

Module No	**Topics**	**No.of Lectures**
1	Construction Project Defined Features of various types of Project report preparation. Basic study, investigations and feasibility studies, project formulation, SWOT analysis, project report	07
2	Project Appraisal What is an infrastructure project, project development cycle, what is appraisal, Need of appraisal, steps of appraisal	07
3	Market appraisal Demand analysis, forecasting demand, sources of information, market survey, uncertainties in demand forecasting Technical appraisal Location, land, buildings, technology and its appropriateness, size of plant, plant and machinery, raw materials, energy requirements, water supply, effluent disposal	07
4	Management appraisal Assessment of entrepreneur, chief executive, board of directors, departmental geads, organization as a whole	07
5	Financial Economic and Environmental analysis Cost of project, means of financing, profitability, break-even analysis, financial projections, financial appraisal tools: urgency, payback period, accounting rate of return, net present value, internal rate of return, benefit cost ratio, cost of capital, risk analysis, social cost benefit analysis	07

6	Project implementation Agencies involved in implementation, methods of implementation like Build, operate and transfer (BOT) method and its variants like BOO, BOOT, BOLT etc. Project financing: types and sources (local and international)	06
7	Project financing issues	07

Term work:-

At least 10 assignments shall be submitted as term work.

Text Books:-

1. Project Preparation, Appraisal, Budgeting, and Implementation: Prasanna Chandra, Tata McGraw Hill.

Sr. No.	Examination	Module
1	T – I	1,2
2	T – II	3,4,5
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE465	**Course :- Elective - II Risk & Disaster Mangement**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To discuss the concept of risk managent.
2. To explain various quantitative techniques of risk management and mitigation measures
3. To describe the concept of disaster managent.
4. To summarize the disaster management process.

Course Outcome:

1. To carry out risk assessment operation and corresponding risk mitigation measures.
2. To identify potential disaster and accordingly formulate disaster management plan.
3. To implement disaster management plan.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Basic concept of Risk, Definition of Risk, Types of risk, Risk & Uncertainty, Failure Mode Effect analysis, Performance Measures, Scope of risk control during project life cycle.	08
2	Decision analysis, Determination of Risk Values, Formalization of Quantitative Risk Assessment, Probabilistic Risk Assessment,	04
3	Risk Registers, Risk priority number, Risk identification, analysis & response measures, Probability Impact matrix.	04
4	Risk analysis in construction projects, Sensitivity analysis, Break even analysis, Scenario analysis, Decision trees, Monte-Carlo simulation, Spider diagram, Probability contours.	04
5	Nature & Extent of disasters, Industrial Hazards, Development of Disaster Management Plans	08
6	Role of Organizations in disaster management, Financing relief operations, Legal aspects.	06
7	Hazard Analysis, personnel training, Information management, Emergency operations and facilities, creating awareness, Effective implementation of Disaster Management system.	06

Term work:-

Assignments consisting of minimum twenty problems covering entire syllabus shall be submitted as term work.

Text Books:-

1. Risk & Decision Analysis in projects, John Schuyler,PMI.
2. Risk Management & Construction, Roger Flangan & George Norman, Blackwell science
3. Risk Management for Design & Construction, Ovidiu Cretu, Robert B. Stewart and Terry

Berends
4. NICMAR publications

Sr. No.	Examination	Module
1	T – I	1,2 & 3
2	T – II	4,5,6 & 7
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE466	**Course :-Elective-II : Advanced Design of Steel Structures**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In semester	01	20*2
	End semester*	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objective	1. To develop Civil Engineering graduates having clear understanding of concepts, and practical knowledge of modern Civil Engineering techniques for design of steel structures. 2. Use of various relevant IS codes for designing steel structures. 3. To encourage students and faculty to interact with industry, alumni and other reputed institutes for purpose of better understanding of industry requirements. 4. To deal with social, environmental and economic issues .
Course Outcome	1. To act as catalyst in transferring the Civil Engineering knowledge to field usage for the socio-economic development of the society. 2. Students should able to independently design steel structures using relevant IS codes. 3. To provide a platform to students, scientists, engineers and working professionals to come together and implement the academic outcome to the field.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Moment Resistant Beam End Connections: Design of moment resistant bolted and welded beam end connections.	08
2	Round Tubular Structural Members Properties of steel tubes, design of tension and compression members, design of welded connections, design of flexural members, analysis and design of tubular trusses including purlins and supports.	10
3	Elevated Steel Tanks and Stacks: Loads acting on tanks including wind and earthquake, design of circular tanks with hemispherical and conical bottom, supporting ring beam, staging for circular tanks including design of columns and foundation,.	07
4	Design of rectangular steel tanks including design of staging, columns and foundation	05
5	Gantry Girder: Loads acting on gantry girder. Analysis and design of gantry girder.	05
6	Lattice Tower: Different configurations of lattice towers, loads acting on lattice towers,	05

	analysis and design of lattice tower including welded or riveted connections for members.	
7	Steel Chimney: Forces acting on chimney, design of self supporting welded chimney and its components including design of foundation.	08

Term work:-

The term work shall consist of a design report and detailed drawings on three projects as indicated below:

1. Design of tubular trusses
2. Design of elevated circular tank with conical bottom or rectangular steel tank
3. Design of lattice tower or steel chimney.

The drawings should be drawn with pencil only on minimum of A1 (Imperial) size drawing sheets. Term work as mentioned above shall be submitted as term work.

Text Books:-

1. Design of steel structures: Subramanian, Oxford Press.
2. Design of steel structures: Negi L.S., Tata McGraw Hill
3. Design of steel structures: Kazimi S.M. A. & Jindal R.S., Prentice Hall of India.
4. Design of steel structures: Krishnamachar B.S, & Ajitha Sinha D.
5. Design of steel structures: Arya and Ajmani, New Chand & Bros.
6. Design of steel structures, Vol I & II: Ramchandran, Standard Book House, New Delhi.
7. Design of steel structures: Dayaratnam, Wheeler Publication, New Delhi
8. Comprehensive design of steel structures: Punamia, A.K. Jain & Arun Kumar Jain, Laxmi Publicalions Pvt. Ltd.
9. Design of steel structures: I C Sayal & Salinder Singh, Standard Publishers & Distributors.

Reference Books:-

1. Steel structures, Controlling behavior through design: R. Englekirk, Wiley
2. Design of steel structures: Breslar, Lin and Scalzi, John Willey, New York.
3. Design of steel structures: Mac. Ginely T.
4. Structural steel work: Reynolds TJ., Kent L.E. & Lazenby, D.W., English University Press.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE467	**Course :-Elective-II : Soil Dynamics**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

60% Weightage for end semester

Soil dynamics is a branch of soil mechanics that deals with behaviour of soil and foundations under dynamic loading. Operation of rotary machines or hammers, and earthquake ground motions are examples of dynamic loads that challenge engineers in their design of different foundations.

Course Objectives:

1. To explain the basics of a vibrating system, degrees of freedom, wave propagation in soil
2. To evaluate liquefaction potential, understand dynamic earth pressure on retaining walls
3. To explain the principles of machine foundation design, vibration isolation and screening methods
4. To recommend field and laboratory tests to determine dynamic properties of soil

Course Outcomes:

The students will be able too understand

1. Apply the basics of dynamics to soil
2. Predict dynamic behaviour of soils,
3. Assess the effects of dynamic loads on behaviour of soil;/rock
4. Design machine foundations and other soil systems subjected to dynamic loading

Course Content

Module No	**Topics**	**No. of Lectures**
1	Vibration of elementary system, Degree of freedom, Analysis of system with one degree of freedom , spring- mass system Harmonic vibration , uniform circular motion, natural frequency, free and forced vibrations with and without damping Type of damping.	10
2	Wave propagation in elastic rods, in an elastic infinite medium, and in semi-elastic half space, wave generated by surface footing.	05
3	Liquefaction of soils , criterion and factors affecting liquefaction of soil, laboratory and field studies on liquefaction, liquefaction studies in oscillatory simple shear, evaluation of liquefaction potentials, liquefaction of clay.	10
4	Principles of machine foundation design, criteria for satisfactory machine foundation, degree of freedom of a block foundation analysis of vertical and	05

	sliding vibration of a machine foundation, mass of soil participating in vibration.	
5	Vibration isolation and screening methods, improvement of distressed machine foundation.	06
6	Field and laboratory tests for evaluation of dynamic properties of soil under vertical vibration coefficient of elastic uniform compression, coefficient of elastic uniform shear, spring constant damping modulus of elasticity typical values of soils	06
7	Basics of dynamic earth pressure on retaining walls: conventional gravity type, reinforced soils, distribution of pressure, point of application of the resultant, simple examples.	06

Term work:-
Each student shall prepare a project report covering the selection of design parameters, design analysis including drawing on any aspect of soil dynamics included in the syllabus.
The project report referred above, at least five examples shall be submitted as term work.

Text Books:-
1. Soil Dynamics: Shamsher Prakash, McGraw-Hill Book Company
2. Principles of Soil Dynamics: Braja M. Das, PWS-Kent Publishing Company
3. Dynamics of Bases and Foundations: D. D. Barkan, McGraw-Hill Book Company.
4. Relevant IS Codes

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3,4
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE468	**Course :-Elective-II : Building Services**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	LaboratoryWork (Journal)	-	-
	Term Work	-	25
	Total		**150**

60% Weightage for end semester

Course Objectives:

1. To discuss the concept of various machineries like lift, escalators, vibrators, concrete mixers etc.
2. To explain utility services in building like pluming system, electrical system, fire safty installation and rainwater harvesting system etc.

Course Outcomes:

The course will enable the students

1. To implement installation of utility services.
2. To identify drawback if all service lines are not install properly or used any faulty materials.
3. To carry out water audit.

Course Content

Module No	**Topics**	**No. of Lectures**
1	**Machineries:** Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity -Hot Water Boilers –Pumps	06
2	**Plumbing Systems in Building:** Plumbing services:-Water distribution system-Material for service pipes-Service connection-size of service pipe-Water meter-Valves-Storage tanks-Drainage system:-Pipe and traps-Sanitary fittings-system of plumbing-House drainage plans-Septic tank-Soak pit	08

3	**Electrical Systems& Illumination Design in Buildings:** **Electrical Systems in Buildings:** Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations **Principles of Illumination Design:** Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.	12
4	**Refrigeration Principles & Applications:** Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems	08
5	**Fire Safety Installation:** Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers	05
6	**Rain Water Harvesting:** Water Audit of India, Concept of rain water harvesting, Methodologies for Percolation/ recharge bore pit, Percolation/ recharge bore well, Percolation/ recharge well cum bore pit, Harvesting rooftop rainwater, Harvesting driveway runoff. National water harvesters network (NWHN). Some case studies.	06

7	**Introduction to Green Building:** Need for a green building, planning and design of green buildings, obstacles, Materials used in green building technology, Rating System (According to LEED-INDIA)	03

Term work:-

At least one site visit should be arranged to give an exposure to various construction techniques discussed in the above syllabus. A report on site, at least 10 assignments (including sketches) shall be submitted as term work.

Text Books:-

1. Heat Pumps and Electric Heating: E.R.Ambrose, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
4. The Lighting of buildings: R.G.Hopkinson and J.D.Kay, Faber and Faber, London, 1969.
5. Air-conditioning and Refrigeration: William H.Severns and Julian R.Fellows, John Wiley and Sons, London, 1988.
6. Air-conditioning and Energy Conservation: A.F.C. Sherratt, the Architectural Press, London, 1980.
7. National Building Code.
8. Building Construction: Dr. B.C. Punmia, Ashol K Jain, A.K Jain
9. Construction Engineering and Management: S. Seetharaman Umesh Publicatins, Delhi.
10. Water supply and Sanitory Installations: A. C. Panchdhari New age international publication, Delhi
11. Fire Safety in Building: V. K. Jain, New age international publication, Delhi
12. Green remodeling: David Johnston.
13. Green Building , Project Planning and Cost Estimation: R.S.Means
14. LEED – INDIA (Abridged Reference guide for Core and Shell, Version 1.0).

Sr. No.	Examination	Module
1	T – I	1,2
2	T – II	3
3	Final Examination	1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE 469	**Course :-Elective-II: Design of Hydraulic Structures**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In Semester	01	20 x 02
	End Semester*	03	100
	Practical/MCQ	-	25
	Laboratory Work (Journal)	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objectives:

1. To discuss different types of dams and their design criteria.
2.
3. study different types of dams and data collection for site selection.
4. To study design criteria for selection of gravity dam.
5. To study different types of arch and buttress dams.
6. To study advantages and limitations of earth and rock fill dams.
7. To study spillways and flood control works.
8. To study principles of hydraulic design of components of hydraulic structures.
9. To study design details of surplus weir, flush escape, direct sluice, canal drop, canal regulator, cross drainage works.

Course outcomes:

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

1. Select site for dam with preliminary and final investigations, fix storage capacity, analyze reservoir losses, and estimate sedimentation in reservoirs.
2. Analyze forces acting on gravity dam its failure and carry out stability analysis of gravity dams.
3. Understand forces on an arch and buttress dams and its design.
4. Understand details of construction and maintenance of earth fill and rock fill dams including stability analysis criteria.
5. Understand design principles of spillways and flood control works.
6. Design small bridges and culverts and its principles ofhydraulic design.

Course Content

Module No	**Topics**	**No. of Lectures**
1	**Dams{General}:** Introduction, classification, comparative study of different types of dams, selection of type of dam, selection of site of dam, preliminary and final investigations of dam sites, fixation of storage capacity, reservoir losses, sedimentation in reservoirs, density currents.	06
2	**Gravity dams:** Criteria for selection of dam site, construction material, forces acting on gravity dam, modes of failure, stability analysis, safety criteria, methods of design , stress analysis and stress contours, galleries, instrumentation, joints, keys, water seals, temperature control in concrete dams, foundation treatment.Spillways and other energy dissipating devices: types.	12
3	**Arch and buttress dams:** Types of arch dams, forces on an arch dam, design. Types of buttress dams.	06

4	**Earth and rock fill dams:** Advantages and limitations, foundation of earth dams, causes and failures of earth dams, design criteria, design considerations in earthquake regions, seepage line for different conditions, filters, upstream blankets, stability analysis, Swedish circle method with pore pressure, details of construction and maintenance, types of rock fill dams, stability analysis, advantages.	10
5	**Spillways and flood control works:** Factors affecting design of spillway, types of spillways, design principles of ogee spillway, chute spillway, siphon spillway and shaft spillway. Design of bucket type energy dissipater and stilling basin, flood mitigation reservoirs. Crest gates, types, advantages, choice, and design of radial gate. Outlet works through dams, intake structures.	10
6	**Design of small hydraulic structures:** Design of small bridges and culverts, data collection, high flood discharge, linear waterway calculation, scour depth, causeways and culverts, principles of hydraulic design.	08
7	**Miscellaneous topics:** Design details of surplus weir, flush escape, direct sluice, canal drop, canal regulator, cross drainage works. Vibration and cavitations in hydraulic structures. Design of air vent.	08

Term work:-
Assignments (on each module) consisting of theory and problems covering entire syllabus shall be submitted as term work.

Text Books:-

1. Irrigation and Water Power Engineering: Dr. B.C. Punmia and Dr. Pande B.B.Lal, Laxmi Publications Pvt. Ltd. New Delhi.
2. Irrigation Water Resources and Water Power Engineering: Dr. P.N. Modi, Standard Book House. Delhi.
3. Irrigation Engineering and Hydraulics Structures: S. K. Gerg, Khanna Publishers. Delhi.
4. Irrigation: Design and Drawing: Murty.
5. Design of Irrigation Structures: S. K. Sharma, S. Chand and Co.
6. Theory and Design of Irrigation Structures: R. S. Varshney and R. C. Gupta, Nem Chand
7. Engineering for Dams, Vol. I to III: by Crager, Justin and Hinds, John Wiley
8. Design of Small Dams: USBR
9. Hydro Power Structures: R. S. Varshney, Nem Chand and Bross.
10. Concrete Dams: R. S. Varshney, Oxford and IBH Publishing Co.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester VIII**
CODE: CE470	**Course :-Elective-II : Transportation Planning and Economics**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	In Semester	01	20*2
	End Semester	03	100 with 60% weightage
	Practical	-	25
	Oral	-	-
	Term Work	-	25
	Total		**150**

*60% Weightage for end semester

Course Objective:

1. To develop skill for four stage modeling and traffic forecasting in transportation planning including the impacts due to land use changes.
2. To impart the knowledge of economic assessment so as to enable students to decide worthiness of any infrastructure project.
3. To make students aware of effectiveness of public transport systems with their suitability and role in developing countires like India.
4. Create awareness about modern computation techniques for transporation planning, modeling and analysis.

Course Outcome:

1. Graduate students should be able to understand travel behavior, forecast trips and assess the travel pattern for future infrastructural facilities. They should be able to justify provision of infrastructural facility based on economic assessment and should be able to decide suitability of a particular mass transport system.

Course Content

Module No	**Topics**	**No. of Lectures**
1	Transportation Planning and management: General Travel Forecasting Principles and techniques, Generalized demand, price and capacity relationship applied to travel forecasting, Practical problems of forecasting travel. Introduction to the process of urban transport planning.	03
2	Travel demand forecasting: Trip generation analysis, trip classification, multiple regression analysis, category analysis, trip distribution analysis: introduction, methods of trip distribution, uniform and average factor method, Fratar method, Furness method, the gravity model and its calibration, Intervening and competing opportunities model, linear programming approach to trip distribution. Modal split analysis: introduction, Modal split analysis: Probit analysis, Logit analysis and Discriminant analysis, modal split models with behavioral basis. Traffic Assignment: purpose of traffic assignment, traffic flow characteristics, Assignment techniques: All or nothing assignment, Multiple route assignment, Capacity restraint assignment, Diversion curves. Rout building algorithms.	15

3	Land-use transport models: Introduction, selection of Land-use transport models, The Lowry model, Grain – Lowry model, Applications of Lowry model.	06
4	Introduction to advanced/soft computational techniques for transportation planning like Expert Systems, Neural Networks, Fuzzy Logic, Genetic Algorithm, Simulated Annealing, Hybrid systems etc.	06
5	Transport Economics: Economic evaluation of highway schemes, need for economic evaluation, cost and benefits of transportation projects, basic principles of economic evaluation, Net present value method, benefit/cost ratio method, internal rate of return method. Vehicle operating costs, Value of travel time saving, Accident costs and road pricing.	08
6	Public Transportation Introduction to various mass transportation systems, Classification of mass transit modes: Street transit or surface transit, Semi rapid transit, Rapid transit or mass rapid transit System, Special transit systems: magnetic levitation, monorails, water borne transport, Automated Guided Transit, Detailed capacity assessment of some selected technologies: Conventional bus on bus bays, Light rail transit, Rail Rapid Transit, Regional rail Transit or Suburban Railway, Suitability of Transit Systems for different travel demand for Indian Cities,	05
7	Suitability of Transit Systems for Indian Cities of Different Population sizes and forms, Influence of other factors in selection of Mass Transit Systems, Transit System Operations: Introduction, Route Development, Stop location and stopping policy, Schedule development, Capacity of transit systems. Future of Public transportation.	05

Term work:-
Mini Project work based on transportation planning or on Public transportation system / Application of transport planning or transport economics software, assignment consisting of at least 15 problems shall be submitted as term work.

Text Books:-

1. Traffic Engineering and Transport Planning: L.R. Kadiyali, Khanna publishers Delhi
2. Principles of Traffic Engineering: G.J. Pingnataro, Mc Graw-Hill, 1970.
3. Traffic System Analysis for Engineering and Planners: Wohl and Martin, Mc Graw Hill, 1983.
4. Introduction to Urban Transport Systems, Planning: B.G. Hutchinson, McGraw-Hill, 1970.
5. Economics of Transportation: Fair and Williams, Harperand Brothers, Publishers, New York.
6. Economic Analysis for Highway: Winfrey, Robley, International Textbook Co., Pennsylvania, USA, 1969.
7. Public Transportation Planning Operation and Management: Gray and Hoel, Prentice Hall Publication.
8. Principles of Transportation Engineering: Partha Chakroborty and Animesh Das, Prentice hall (India)

Sr. No.	Examination	Module
1	T-1	1,2
2	T-2	3,4,5
3	Final Examination	Module 1 to 7

Class:- B. Tech. (Civil)			**Semester-VIII**
CODE : CE 471	**Course :- Elective-II: Advanced Construction Engineering**		
Periods per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Scheme of Evaluation	Theory Examination	03	100
	Practical	-	25
	Oral	-	-
	Term Work	**-**	**25**
	Total		**150**

*60% Weightage for end semester

Equipments: Construction is the ultimate objective of a design and it is the machines which make it possible in a fast and economical way. For the successful completion of a project a constructor has to choose the right set of equipments to complete a particular work in the specified time and with involvement of minimum labour. Thus planning, selection and utilization of any construction equipment helps one to analyze the operational problems on the site and to arrive at practical solutions for completing a task.

Techniques: Simply relying on the appropriate use of suitable equipments cannot be replied upon for the successful completion of any construction project. Understanding the correct construction techniques is vital for making optimal use of the equipments used.

Course Objectives:

1. to learn about the characteristics and complexities of major construction activities
2. to study the excavation methods in various types of soils for large and heavy engineering projects
3. to understand the importance of selection of appropriate equipment and techniques in concrete construction for heavy engineering projects
4. To study prefabricated construction.

Course Outcomes:

At the end of this course the students will

1. Be able to select appropriate equipment for large and heavy construction project from planning to execution relating to excavation for foundations, concreting, pre-fabricated construction, steel construction.
2. Understand importance of implementing quality and safety measure during fabrication and erection of steel, structures.
3. Be able to carry out detailed planning related to complex large size construction projects such as dams, powerstation, airports, bridges etc.

Detail Syllabus

Module No	**Topics**	**No of Lectures**
1	Large and heavy engineering projects: Characteristics and complexities, methods statement for major activities like excavation, concreting, steel fabrication and erection for projects like earthen dams, hydropower projects, nuclear power plant, refineries and other industrial projects etc. New materials and equipment for construction	08
2	Excavation for heavy engineering projects:	08

	Excavation in various types of soils, selection of equipment, safety measures in excavation, drainage in excavation, New materials and equipment for construction	
3	Concrete construction for heavy engineering projects: Selection of equipment for batching, mixing, transporting, placing and compacting for various types of jobs, safety measures during concreting, Special concretes and mortars: preplaced aggregate concrete, roller compacted concrete, grouting, New materials and equipment for construction	07
4	Prefabricated construction: Planning for pre-casting, selection of equipment for fabrication, transport and erection, quality measures, safety measures during erection	05
5	Steel construction: Planning for field operations, selection of equipment and erection tools, tools and methods of welding, tools and methods of cutting and joining , bridge erection, quality measures, safety measures during fabrication and erection	05
6	Specific issues related to planning, site layouts, equipment selection and pre-project activities for large size construction projects like earthen dams, concrete dams, thermal power stations, nuclear power stations, light houses, airports and ports, bridges, Information related to special equipments and their applications to off-shore construction, underground utility construction,	10
7	Case studies of heavy construction projects	05

Term work:-
A detail report of site visit to any heavy construction work, at least five assignments shall be submitted as term work.

Text Books:-

1. Erection of Steel Structures: Thomas baron
2. Handbook of Heavy Construction: Stubbs, McGraw Hill, New York
3. Journals of Civil Engineering and Construction Engineering

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3,4,5
3	Final Examination	1 to 7