DEPARTMENT OF TECHNOLOGY
FINAL YEAR B. TECH.
Scheme of Teaching and Examination
Semester – VII (Civil Engineering)
To be implemented from Academic Year 2023-24

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing$	Scheme	Max. marks	Min. Passing
CE 411	Design of Concrete Structures- I	03	01	-	04	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE 412	Structural Dynamics and Earthquake Engineering	03	-	-	03	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE 413	Estimating and Costing	03	-	-	03	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE 414	Water Resources Engineering - II	03	-	-	03	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE	Elective-I	04	-	-	04	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	---------
CEL 415	Major Project Phase-I **$**	-	-	02	03	------	-------	--------	EOE	50	20
CEL 416	Lab-I RCC Design and Drawing - I	-	-	02	01	------	-------	------	IOE	50	20
CEL 417	Lab-II Structural dynamics and Earthquake Engineering	-	-	02	01	------	-------	--------	EOE	50	20
CEL 418	Lab-III Estimating and Costing	-	-	02	01	--------	-------	--------	EOE	50	20
CEL	Lab IV Elective-I	-	-	02	01	--------	-------	--------	IOE	50	20
CEL 419	Internship III	-	-	-	01	--------	------	-----	IOE	50	20
	Total	**16**	**01**	**10**	**25**	--------	**500**	--------	-------	**300**	--------
Audit Course - VI											
AC 416	Introduction to Constitution of India	2	-	-	-	Institute/ Departmental Level	100	--------	-------	-------	40

Total Credits: 25, Total Contact Hours/Week: 29 hrs

$: In theory student should appear for the CIE (Mid Semester Exam) and submit the assignment and must secure 40% marks in SEE

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

• Contact hours of 2 with Guide for Project Phase I for a group of students. (AICTE guidelines)

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,
IPE – Internal Practical Evaluation, EPE–External Practical Examination,
IOE– Internal Oral Evaluation, EOE–External Oral Examination

Note: After semester VI, during vacation period, students will undergo Internship III for minimum 4 weeks in a reputed industry from standpoint Civil Engineering principles. The students will submit a report of the training. This particular activity is equivalent to one credit and it carries 50 marks as an Internal Oral Evaluation (IOE) which is included in Semester VII. For submission of the activity report, all the students will follow one specific format recommended by the Program Advisory Board.

Elective-I

CE 428 Advanced analysis of structure

CE 429 Green Building Design

CE 430 Human Resource Management in construction

CE 431 Transportation in Infrastructure planning and Demand Estimation

CE 432 Watershed Management

Lab IV Elective-I

CEL 433 Advanced analysis of structure

CEL 434 Green Building Design

CEL 435 Human Resource Management in construction

CEL 436 Watershed Management

CEL 437 Transportation in Infrastructure planning and Demand Estimation

DEPARTMENT OF TECHNOLOGY
FINAL YEAR B. TECH.
Scheme of Teaching and Examination
Semester – VIII (Civil Engineering)

To be implemented from Academic Year 2023-24

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing$	Scheme	Max. marks	Min. Passing
CE 421	Design of Concrete Structures-II	03	01	-	04	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE 422	Construction Practices	03	-	-	03	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE 423	Town and Country Planning	03	-	-	03	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE	Elective-II	04	-	-	04	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	--------
CE	Elective-III	04	-	-	04	CIE	30	40	-------	-------	--------
						SEE	70		-------	-------	---------
CEL 424	Major Project Phase - II	-	-	02$	04	--------	-------	--------	IOE	50	20
									EOE	100	40
CEL 425	Lab-I RCC Design and Drawing - II	-	-	02	01	--------	-------	--------	EOE	50	20
CEL	Lab-II Elective-II	-	-	02	01	--------	-------	--------	EOE	50	20
						--------	-------	--------			
CEL	Lab-III Elective-III	-	-	02	01	--------	-------	--------	IOE	50	20
	Total	**17**	**01**	**08**	**25**	--------	**500**	--------	-------	**300**	--------
Audit Course - VII											
AC 427	Professional Ethics	02	-	-	02	Institute/ Departmental Level	100	40	--------	--------	--------

Total Credits: 25, Total Contact Hours/Week: 28 hrs

Note:

$: In theory student should appear for the CIE (Mid Semester Exam) submit the assignment and must secure 40% marks in SEE

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

$ Students are expected to do self-study for 2 hrs as per the guidance given by the project guide hence contact hours to be taken as 2 for the calculation of contact hrs.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,

IPE – Internal Practical Evaluation, EPE–External Practical Examination,

IOE– Internal Oral Evaluation, EOE–External Oral Examination

Elective-II

CE438 Advanced Design of Structures

CE439 Advanced Geotechnical Engineering

CE440 Development Engineering

CE441 Design of Concrete Bridges

CE442 Structural Dynamics

CE443 Advanced Surveying

Lab II Elective-II

CEL 444 Advanced Design of Structures

CEL 445 Advanced Geotechnical Engineering

CEL 446 Development Engineering

CEL 447 Design of Concrete Bridges

CEL 448 Structural Dynamics

CEL 449 Advanced Surveying

Elective-III (Open Elective)

CE 450 Engineering Optimization

CE 451 Engineering Economics and Valuation

CE 452 Finite Element Method

CE 453 Numerical Methods

CE 454 Remote Sensing and GIS application

or

Passing certificate of any one SWAYAM Course in Civil Engineering

Lab III Elective-III (Open Elective)

CEL 455 Engineering Optimization

CEL 456 Engineering Economics and Valuation

CEL 457 Finite Element Method

CEL 458 Numerical Methods

CEL 459 Remote Sensing and GIS application

or

Passing certificate of any one SWAYAM Course in Civil Engineering

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**DESIGN OF CONCRETE STRUCTURES -I**			***Course Code*:**	**:**	CE 411
Teaching Scheme (Hours)	**:**	Lecture : 3 hr/week Tutorial : 1hr/week			**Credits**	**:**	04
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	4 hrs.
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 223, CE 211, CE 221.					
Course Domain	**:**	Core					

Course Rationale: *The objective in RCC structure design is to produce a structure capable of resisting all applied loads without failure during its intended life. The objective can be fulfilled by: (i) Understanding the strength and deformation characteristics of concrete and steel, (ii) Following the clearly defined standards for materials, production, workmanship and maintenance, and use of structures in service, (iii) Adopting measures needed for durability.*

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To develop basic understanding of reinforced concrete as a construction material.	1.	**Analyze** the structural members under various applied gravity loadings.
2.	To develop understanding of various design philosophies and their differences.	2.	**Explain** various design philosophies and their differences.
3.	To understand behavior of RCC elements under flexure, shear and axial stresses.	3.	**Design** the structural members for axial force, shear force and bending moment using limit state design philosophy
4.	To prepare the structural drawing of various RCC elements using the guidelines in design codes.	4.	**Prepare** the structural drawing of various RCC elements using the guidelines in design codes.

Curriculum Content	**Hours**
Unit I a) Design philosophies- Working stress method, ultimate load method and limit state method. Assumptions, merits and demerits of each. Material properties, stress- strain behavior, factor of safety. b) Limit state design philosophy- Various limit states, its significance.	6
Unit II: Beams a) Limit state of collapse- Theory of singly and doubly reinforced beams, flanged beams. Under- reinforced, over- reinforced and balanced sections. Design of under flexure. Design of beams for shear, bond and anchorage. **b)** Limit state of Serviceability- Deflection and cracking.	8
Unit III: Columns Design of Columns: Short and slender columns, effective length. Axial loaded columns, columns subjected to uni-axial and bi-axial moments, interaction diagrams. IS: 456-2000 provisions for design of short and slender compression members.	8

Unit IV: Slab Design of one-way and two-way slabs. Simply supported and restrained slab. Design of continuous slab using moment and shear coefficients. Torsion reinforcement in restrained slabs. Check for shear and deflection.	7
Unit V: Column footing Isolated column footing. Footing subjected to axial load, uni-axial and biaxial moments. Eccentric footings.	5
Unit VI: Stair Design of stair- Loading calculations. Design of stairs spanning horizontally and spanning longitudinally. Reinforcement detailing.	5

Suggested list of Tutorials and Assignments:

1) Assignment 1- Calculation of M.R. of Singly, doubly and flanged section
2) Assignment 2- Design of continuous beam
3) Assignment 3- Design of Columns with footing
4) Assignment 4- Design of slab panel with different support conditions.
5) Site visit reports

General Instructions: Site visits will be organized to see the reinforcement detailing in various RC members. Student has to submit detail report of each visit.

Suggested Text Books:	
1.	N.C. Sinha and S.K. Roy, "Fundamentals of Reinforced Concrete", S. Chand publications, 4th edition, 2013.
2.	B.C. Punmia, A.K. Jain and A.K. Jain, "Comprehensive Design of R.C. Structures", Laxmi Publications,10th edition, 2015.
3.	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures Publications, 8th edition, 2014.
4.	A.K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand and Brothers-Roorkee, 7th edition, 2012.
Suggested Reference Books:	
1.	P.C. Varghese, "Limit State Design of Reinforced Concrete", Prentice-hall of India Pvt. Ltd. , 2nd Edition, 2004
2.	M. L. Gambhir and McMillan, "Reinforced Concrete Design", PHI learning Pvt. Ltd, 4th Edition, 2006
Reference Design codes:	
1.	IS456-2000: Plain and Reinforced Concrete - Code of Practice
2.	IS 13920-2016: Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice
3.	SP 34-1987: Handbook on Reinforcement and Detailing

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING**			***Course Code*:**	**:**	CE 412
Teaching Scheme (Hours)	**:**	Lecture :	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial :	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, CE 212, CE 221, CE 225, CE 321					
Course Domain	**:**	Core					

Course Rationale: *The course deals with vibration theory of the structures in terms of Structural Dynamics and Earthquake Engineering. The course aims at the appropriate design and construction of buildings in accordance with building codes, which is essential to minimize the damage due to earthquakes.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain the behavior of earth surface during earthquake.	1.	Know the structure and behavior of earth during earthquake.
2.	Illustrate the vibration theory of structures.	2.	Comprehend of the vibration theory of structures.
3.	Describe response of building during earthquake and	3.	Describe response of building during earthquake
4.	Illustrate the procedure to evaluate seismic force as peer IS: 1893-2016	4.	Evaluate seismic force as per IS:1893-2016
5.	Describe the ductile detailing of structures.	5.	Know the specifications of the ductile detailing of structures.
6.	Explain various seismic devices techniques	6.	Know and understand the concept of vibration isolation and techniques.

Curriculum Content	**Hours**
Unit I **Seismology** Seismic activities of a region-India, local geology and soil condition, quantification, magnitude, energy and intensity of earthquake. Analysis of earthquake data, seismic zoning, causes of earthquake damage, history of past earthquake	4
Unit II Vibration Theory Free and forced vibration of single degree, two degree, damping, modal analysis techniques, response spectra.	10

Unit III Structural Form and Response to Earthquakes Form of super structure, regular, irregular form of structures, Response of load bearing masonry building and RC building with brick infill Lateral load resisting system, guidelines for efficient seismic designs	6
Unit IV Concept of Seismic Design, Evaluation of seismic force as per Indian code, lateral load analysis of building.	6
Unit V Codal Provisions for Ductile Detailing of RC Structures subjected to Seismic Forces Design of Flexural members, Design of columns and frame members subjected to Bending and axial load, Design of joints of frame.	7
Unit VI New Techniques in Aseismic Design Base Isolation Technique, Seismic dampers, Retrofitting and strengthening of structures.	6

Suggested list of Tutorials and Assignments:
At least one assignment on each unit.

Suggested Text Books:

1.	Hosur V.I., "Earthquake Resistant Design of RCC structures", Willey Publication
2.	Paz Mario, "Structural Dynamics", CBS Publishers and Distributers, 2004

Suggested Reference Books:

1.	Arya A.S., "Earthquake Resistant, Design of Masonry and Timber Structures",
2.	Clough R.W. and Penzien Joseph, "Dynamics of Structures", McGraw Hill Co.
3.	Dowrick D.J., "Earthquake Resistant Designs", John Wiley and Sons
4.	Gosh S.K., "Earthquake Resistant Design of R. C. C. Structures"
5.	Grover G.R., "Mechanical Vibrations", Roorkee University, Roorkee.
6.	Krishna Jai, "Elements of Earthquake Engineering", South Asian Pub. New Delhi
7.	Pankaj Agarwal and Shrikhande Manish, "Earthquake Resistant Design of Structures", Prentice Hall of India, New Delhi, 2006
8.	Chopra A.K., "Dynamics of Structures", Prentice Hall of India Pvt. Ltd. 2006
9.	Duggal S.K., "Earthquake-Resistant Design of Structures", Oxford University Press
10.	Government of Maharashtra Earthquake resistant Design of house guidelines and assessment of damages
11.	Manual of Earthquake Resistant Non engineering Construction, University, Roorkee

Reference Code:

IS 1893 (Part 1) :2016, Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings
IS 13920 : 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces — Code of Practice
IS 4326 : 2013, Earthquake Resistant Design and Construction of Buildings — Code of Practice
IS 13827 : I993, Improving Earthquake Resistance of Earthen Buildings-Guidelines
IS 13828 : 1993, Improving Earthquake Resistance of Low Strength Masonry Buildings— Guidelines
IS 13935: 1993, Guidelines for Repair and Seismic Strengthening of Buildings

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**ESTIMATING AND COSTING**			***Course Code*:**	**:**	**CE 413**
Teaching Scheme (Hours)	**:**	Lecture :	03 Hrs/week		***Total Credits***	**:**	***03***
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-12A2, CE213, CE222, CE224.					
Course Domain	**:**	Core					

Course Rationale: *To provide the student with the ability to estimate the quantities of item of works involved in buildings, water supply and sanitary works, road works and irrigation works, and also to equip the student with the ability to do rate analysis, fill tenders, prepare contract, valuation of properties and preparation of reports for estimation of various items.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To provide students necessary knowledge and skills in estimation of civil works	1.	To Understand concept of estimates and types of estimate for various for Civil Engineering works.
2.	To draft detailed specification and work out rate analysis according to material, labor requirements as per specified norms.	2.	To understand Specification if work and Calculate rates for various items of construction.
3.	To understand detailed estimate and BBS.	3.	Prepare estimates for various civil engineering works and BBS.
4.	To understand procedure of contracts	4.	To prepare actual contract form.
5.	To understand procedure of tenders.	5.	To prepare and fill tenders.
6.	To carry out valuation of civil engineering structures	6.	Prepare valuation report for residential building.

Curriculum Content	**Hours**
Unit I **Introduction**: Purpose of quantity estimates, Types of estimates, Various items to be included in estimates, Modes of measurement and units of measurement as per codal provision IS1200, Administrative approval and Technical sanction to estimates, Introduction to SSR (State Schedule Rate), Prime cost, Provisional sum and provisional quantities.	7

Unit II **Specifications**: Purpose, basic principles, general and detailed specifications for various items related to building. Approximate estimates, purpose, Various methods used for buildings and other civil engineering works. **Measurement of Quantities**: Long wall- Short wall method and Center line method, measurement sheet and abstract sheet. Analysis of rates, Factors affecting cost of an item work, materials, sundries, labour, tools and plant, overheads and profit. Task work- Definition and factors affecting task work. Analysis of rates of items related to building, Price Escalation.	7
Unit III **Detailed Estimation:** Methods of computation of volume of earthwork such as mean area method, mid-sectional area method, Prismoidal formula, Trapezoidal formula, Spot level method etc. & numericals based on methods. Mass haul diagram & its necessity, Terms like lead & lift etc. Earthwork for road construction, estimate of road/highway works, estimate of steel roof truss, estimate of a culvert, water tank (elevated storage tank). Preparation of detailed estimate of R.C.C framed structures. Bar Bending Schedule & its necessity, preparation of bar bending schedule of various structural elements as per code IS2502.	7
Unit IV **Tenders (Bids):**Meaning, Categories, Tender notice, Notification in press and media, e-procurement, ,National Building Code (NBC) Corrigendum, Preparation and Submission of tenders, Tenders form and information, EMD and SD, revocation of tenders, opening of tenders, qualification of contractors, Scrutiny of tenders, unbalanced tenders, acceptance of tenders, running bills and final bills. E-Tendering.	7
Unit V **Contracts:** General idea, Types of contracts viz: lump-sum, item rate, percentage rate, cost plus, Engineering Procurement Construction (EPC). Conditions of contracts, Law of contract. Definition, objective and essentials of valid contract, Termination and breach of contracts, Negotiated contracts, Demolition contracts, Non-conventional contract such as PPP, B.O.T, B.O.O.T.,B.O.L.T. **Dispute resolution methods** Causes of disputes & disputes resolution methods such as litigation, mediation & arbitration	6
Unit VI Difference between cost, price & value. Types of value, Valuation & its purposes. Various terms such as depreciation, sinking fund, capitalized value, years purchase, Annualized value etc. Methods for calculating depreciation of building. B. Methods of valuation such as Rental method, land & building method, Belting method etc. C. Real estate, rent fixation, Tenure of land, Freehold Properties, Leasehold Properties, Easement rights. D. Numerical based on valuation.	6

Suggested Text Books:

1.	A Textbook of Estimating and Costing (Civil), D.D. Kohli and R. C. Kohli, S. Chand & company, New Delhi**.**
2.	Civil Engineering Contracts and Estimates, B. S. Patil, Universities press
3.	A Text Book of Estimating and Costing for Civil Engineering, G.S. Birdie, Dhanpat Rai Publishing Company

4.	Valuation of Real Properties by S.C. Rangwala, Ketki B. Dalal, Charotar Publishing house, 9th edition, 2013.
Suggested Reference Books:	
1.	Estimating, Costing Specifications & valuation in Civil Engineering, M. Chakraborty.
2.	Estimating and Costing in Civil Engineering: Theory and Practice, B.N. Dutta and S. Dutta, 28th revised edition, CBS Publishers and distributors.
3.	Estimating and Costing, R. C. Rangwala, Charotar Publishing House Pvt Ltd, Anand.
4.	Theory and Practice of Valuation, Dr. Roshan Namavati, Lakhani Publications.
5.	Valuation Principles and Procedures, Ashok Nain, Dew point Publication.
6.	Laws for Engineers, Dr. Vandana Bhat and Priyanka Vyas, Pro Care.
7.	Standard contract clauses for domestic bidding contracts: ministry of statistics and program implementation, Government of India.
8.	Quantity Surveyor's Pocket Book by Duncan Cartlidge.
9.	IS 1200: --- (Part 1 to 25): Methods of Measurement of Building & Civil Engineering Works, Bureau of Indian Standards, New Delhi.
10.	IS 3861:1966, Method of measurement of areas and cubical contents of buildings, Bureau of Indian Standards, New Delhi.
11.	Standard specifications volumes I and II (PWD Maharashtra) Govt. of Maharashtra
12.	CPWD Specifications
13.	CPWD Schedules of Rates
14.	PWD Hand Book and Red Book
15.	PWD Schedule of Rates – Latest
16.	National Building Code of India – Guidelines for regulating the building construction activities.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**WATER RESOURCES ENGINEERING -II**			***Course Code*:**	**:**	CE 414
Teaching Scheme (Hours)	**:**	Lecture :	3 Hrs./week		***Total Credits***	**:**	03
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs.
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-12B2, CE 214,CE 223, CE 322					
Course Domain	**:**	Core					

Course Rationale: *The course mainly deals with different hydraulic structures, their functioning, components, practical application and significance. This course requires the student to know about the basic concepts regarding various dams, their site selection and design of various dams, spillways, river training works*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To make the students to be able to know the different types of hydraulic structures.	1.	Demonstrate the theoretical and practical aspects of irrigation processes and structures.
2.	To make a student visualize, know and understand the working of different hydraulic structures	2.	Explain the working of hydraulic structures.
3.	To expose the students to the sites where hydraulic structures have been implemented.	3.	Assess the stresses in different irrigation structures
4.	To make the students to be able to compute the stresses in different hydraulic structures.	4.	Test the stability of hydraulic structures.

Curriculum Content	**Hours**
Unit I **a) Introduction to dams:** Types of dams, selection of site for dams, selection of type of dam, Storage Calculations using mass curves, Area elevation curve & Elevation capacity curve, Control levels, silting of reservoirs, control of Losses in reservoirs. **b) Earthen dam:** Types of earthen dams, Components and their functions, methods of construction of earthen dam, Design criterion, plotting of phreatic line, Modes of failure, seepage control measures Drainage & filters, stability of slopes for sudden drawdown & steady seepage.	08
Unit II **a) Gravity Dams:** Forces acting on dam, Design Criterion-theoretical and practical profile, high and low dam, fixing section of dam, stability analysis, and methods of construction, galleries and joints in dams. Arch dams- Introduction & types only. Introduction to instrumentation in dams.	06
Unit III	07

a) Spillway: Necessity and function components of spillway, different types, factors affecting choice of type of spillway. Elementary hydraulic design, types of energy dissipation arrangements, gates for spillway. **b) Outlets in Dams:** Outlets through concrete and earth dams, different types.	
Unit IV **a) Diversion Head Works:** component parts & their functions, types of weirs and barrages, Causes of failure and remedies, Introduction to Theory of seepage- Bligh's creep theory, critical exit gradient, Khosla's theory	07
Unit V **a) Canals:** Types, alignment, typical sections of canals, balancing depth Kennedy's and Lacey's silt theories, canal lining-purpose, types, selection and economics. **b) C. D. Works:** Necessity, Types. **c) Canal Regulatory Works:** head regulator, cross regulator, canal fall, canal escape, standing wave flume.	06
Unit VI **a) River Training Works:** Hydraulics of alluvial rivers, meandering, aggradations and degradation, river training, necessity, river training works and bank protection, various measures and their design and construction principles.	06

Suggested list of Tutorials and Assignments:

Assignment No. 1: Types of Dam & Earthen Dam
Assignment No. 2: Gravity Dam with Failure and design Problems.
Assignment No. 3: Types of Spillway and Gates
Assignment No. 4: Component and theories of Diversion Head Works.
Assignment No. 5: Canal and C.D. Works.
Assignment No. 6: River Training Works Design and Construction

General Instructions: Along with curriculum to expose students to various aspects in relation to course contents. Preparation of assessment as per unit wise.

Suggested Text Books:

1.	Punmia, Irrigation and water power engineering_, 1986. Standard Publications, New Delhi.
2.	Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers Delhi, 2007
3.	Modi P.N., Irrigation, "Water Resource and Water Power Engineering", Standard Book House, Delhi, 2008.
4.	Satyanarayan Murty, Water resources Engg., New age international private Ltd.

Suggested Reference Books:

1.	Justinn, Creager and Hinds, Engg. For Dams Vol. I, II, III
2.	Varshney, Design of hydraulic structures
3.	U.S.B.R., Oxford and IBH Publ. Co. Design of small dams
4.	Varshney, Design of hydraulic structures

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering) Part IV, Semester VII**					
Course Title	**:**	**ELECTIVE-I ADVANCED ANALYSIS OF STRUCTURE**			***Course Code*:**	**:**	CE 428
Teaching Scheme (Hours)	**:**	Lecture :	4 hr./ week		***Total Credits***	**:**	04
		Tutorial :	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs.
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 211, CE 221.					
Course Domain	**:**	Elective					

Course Rationale: *The objective in advance analysis of structure is to expose the students to advanced level of structural analysis using special methods of analysis.*

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To impart the knowledge of advanced methods of structural analysis.	1.	**Apply** advanced methods for analysis of structures.
2.	To provide knowledge for analyzing special types of structures.	2.	**Calculate** forces and displacements for special structures.
3.	To prepare students to develop computer programs by using matrix methods of structural analysis.	3.	**Formulate** program by using matrix methods of structural analysis for field applications.

Curriculum Content	**Hours**
Unit I: Influence line diagrams a) Basics in structural analysis: Types of structures, various loads and methods of structural analysis, energy theorems and application of virtual work principle. Introduction to basic software's for structural analysis. b) Influence line diagrams for Indeterminate Structures: Concept of ILD, Muller-Breslau's principle and its application for propped cantilever, fixed beam and continuous beams.	9
Unit II: Fixed arches Analysis of fixed arches by elastic center method.	8
Unit III: Beams Curved in Plan Structural behavior of curved beam. Analysis of determinate and indeterminate beams curved in plan, bent beams.	9
Unit IV: Analysis of frames Stiffness method of analysis, analysis of sway and no sway frames. (SI=2) Approximate method of analysis of multi-storey frames: analysis of portal frames subjected to lateral loads – portal method, cantilever method.	9
Unit V: Analysis of space trusses Analysis of space trusses by tension coefficient method analysis of secondary stresses in plane frames	8
Unit VI: Beams on elastic foundation	9

Long, short and intermediate foundations, governing differential equation, analysis under point load, couple and uniformly distributed loads.	

Suggested list of Tutorials and Assignments:

1) Assignment 1- ILD for continuous beams, fixed beams and propped cantilever
2) Assignment 2- Analysis of fixed arches.
3) Assignment 3- Analysis of curved beams with different loadings and support conditions.
4) Assignment 4- Analysis of frames by approximate methods.
5) Example solved using software.

General Instructions: Student should aware of modelling and analysis of simple structures like 1-D and 2-D elements in relevant software.

Suggested Text Books:	
1.	VaziraniV.N. and Ratwani M.M., "Advanced Theory of Structures", Khanna Publishers, 2008
2.	Timoshenko S. P. and Gere. J. M., "Theory of Elastic Stability", Tata McGraw-Hill Publishing company Ltd., 2nd Edition,1985
3.	Gere J. M. and Weaver. W., "Matrix Analysis of Framed Structures", CBS Publishers and Distributor, 2nd Edition, 2004.
4.	Krishna Raju N., "Advanced Mechanics of Solids and Structures", McGraw-Hill Education, 08-Nov-2018 - Technology & Engineering
Suggested Reference Books:	
1.	John L. and Meek, "Matrix Structural Analysis", McGraw Hill Book Company, illustrated,1971
2.	Pandit G. and Gupta S., "Structural Analysis - A Matrix Approach 2008", McGraw Hill Education; 1st edition

Class & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title		**ELECTIVE-I GREEN BUILDING DESIGN**			***Course Code*:**	**:**	CE 429
Teaching Scheme (Hours)	**:**	Lecture :	04 Hrs/week		***Total Credits***	**:**	04
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE= 30	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hrs
Revision:		Second			***Month***	**:**	June 2023
Pre-requisites	**:**	The prerequisite for this course is to possess the fundamental knowledge of Green Buildings					
Type of Course	**:**	Theory					
Course Domain	**:**	Elective					
Skills Imbibed	**:**	Cognitive, Affective domain, Psychomotor					

Course Rationale: Designing buildings by applying eco-friendly methods and technologies is gradually gaining ground for the last few decades for sustainable future. It is apparent that energy efficiency and sustainable construction practices will be a driving factor in the construction industry. Hence, to understand green building principles the course is included in the syllabus.

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To study the building materials and its impact on environment.	1.	Insight on environmental impact of building materials.
2.	To insight into various Energy Efficient materials and Sustainable construction Technology	2.	Understanding of building materials and construction techniques that are sustainable and energy efficient.
3.	To know the methods to evaluate the performance of buildings	3.	Know green building design techniques.
4.	To learn the green buildings concepts applicable to alternate design.	4.	Select appropriate green building material and technique.

Curriculum Content:	**Hours**
Unit 1- Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits. Environment Energy concepts in building materials and buildings, Global warming and Environmental issues related to building materials, Passive and Active Energy Systems, Buildings and Climate, Cost Effective vs. Energy Efficiency in Buildings.	9

Unit 2 – Green Building Materials Concepts of energy efficient & environment friendly materials Cost effective green building materials: - Soil, Fly ash, Ferrocement, Lime, Fibres, Stone Dust, Red mud, Gypsum, Alternate Wood, Polymer. Energy Efficient & Environment friendly building material techniques and products: - Walls - Stabilized and sun dried, soil blocks & bricks, Solid & Hollow concrete blocks, stone masonry blocks, Ferrocement partitions. Roofs - Precast R.C. Plank & Joists roof, Precast channel roof, Precast L-panel roof, Precast Funicular shells, Ferro cement shells, Filler Slab, Seasal Fibre roof, Improved country tiles, Thatch roof, M.C.R. tile.	8
Unit 3- Sustainable Building Construction **Aspects** - Environment Aspect, Economical aspect, Social aspect. **Principles** - Optimize site potential, minimize non-renewable energy consumption, use environmentally preferable products, protect and conserve water, enhance indoor environmental quality and optimize operational and maintenance practices. **Technologies** – Use of Solar Power, Biodegradable Material use and its importance, Green Insulation, Cool Roofs, Sustainable Resource Sourcing, Water Efficient Technologies, Sustainable Indoor Environment Quality Improvement Technologies, Passive House, Rain Water Harvesting.	9
Unit 4 - Environment friendly and cost effective Building Techniques Different substitute for wall construction –Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames - Water tanks - Septic Tanks. Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof - hollow concrete block roofs / floors -Pre-engineered and ready to use building elements - wood products - steel and plastic. Contributions of agencies - Costford - Nirmithi Kendra – Habitat. Masonry Domes and Vaults: Historical notes, Relevance of vaults and domes, Analysis and design of brick masonry domes, construction of masonry domes, design of brick masonry vaults, Construction of vaults, Problems of lateral thrust, Vaults and domes.	8
Unit 5 – Climate Change and Carbon Footprints Global Warming – Definition - Causes and Effects - Contribution of Buildings towards Global Warming.	

Carbon Footprint – Global Efforts to reduce carbon Emissions. Major Energy efficient areas for buildings – Embodied Energy in Materials Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.	9
Unit 6 - Green Building rating Systems IGBC, BREEAM – GREEN STAR - GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only).	9

Suggested Text Books:	
1.	Ming Yang, Xin Yu., "Energy Efficiency: Benefits for Environment and Society (Green Energy and Technology)", 2015 Edition, Springer.
2.	Fernando Pacheco-Torgal, Claes-Göran Granqvist, Bjørn Petter Jelle, Giuseppe Peter Vanoli, Nicola Bianco, and Jarek Kurnitski "Cost-effective energy-efficient building retrofitting material, technology, optimization and case studies", Woodhead publishing.
3.	Izzet Yüksek and Tülay Tikansak Karadayi, "Energy-Efficient Building Design in the Context of Building Life Cycle", Intech Open
4.	Abe Kruger, Carl Seville, "Green Building: Principles and Practices in Residential Construction (Go Green with Renewable Energy Resources)", Hardcover
Suggested Reference Books:	
1.	Jagadish K.S., Reddy B.V.V., Nanjuda Rao K.S., "Alternative Building Materials and Technologies", New Age International Publishers
2.	Sam Kubba, "Hand book of Green building Design and construction", Elsevier Architecture Press.
3.	Balaguru P.N. and Shah S.P., "Fibre reinforced Cement Composites", McGraw Hill, Inc.
4.	Kibert, C. "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2005
5.	Neville A.M., "Properties of Concrete", ELBS, Longman.
6.	Hannant D. J., "Fibre cements and Fibre Concretes", John Wiley and Sons.
Suggested IS Codes:	
1.	IS Code 2250 – 1981 Preparation and use of masonry mortars
2.	IS Code 3620 - 1979 Specification for laterite stone block for masonry
3.	IS Code 1077 – 1992 Common Burnt Clay Building Bricks - Specification
4.	IS Code 2572 – 2005 Construction of Hollow and Solid concrete block masonry

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**ELECTIVE-I HUMAN RESOURCE MANAGEMENT IN CONSTRUCTION**			***Course Code*:**	**:**	CE 430
Teaching Scheme (Hours)	**:**	Lecture : 4 Hrs/week Tutorial : -- Hrs/week			***Total Credits***	**:**	4
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 315					
Course Domain	**:**	Elective					

Course Rationale: *Human resource management (HRM) is most important function for any successful business organization.HR Professional has to carry out important tasks such as recruitment process, training and orientation of employees, motivation, direction. HRM plays most important role in construction sector as a lot of people are involved in this process. This course will give an overall understanding about the concept and practices related to Human Resource Management in construction. It will give a comprehensive understanding of the need and relevance of Human Resource systems required in any organizations. Student will also get a basic understanding of the Strategic Human Resource Management.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To develop an insight into meaning, nature scope and value of human resource management in an organization.	1.	To have the basic understanding of Human Resource Management system.
2.	To impart knowledge and techniques involved in human resource planning.	2.	Understand the nature and need of HRP, HRP process and factors affecting HRP
3.	To explain the concept of Personnel Management and other relevant skills.	3.	To have the clarity about Personnel Management, Role and functions of personnel manager, other skills such as decision making, leadership and qualities of leadership.
4.	To explain various methods of recruitment, selection, induction and placement.	4.	To get clear idea about the recruitment process, orientation programme and team work required in any organization.
5.	To explain the importance of training for development of organization.	5.	To understand importance of Training and other aspects influencing development of organization
6.	To explain the importance of motivation, promotion, labour laws, SWOT analysis and employees' health.	6.	To understand importance of motivation, promotion, labour laws, SWOT analysis and employees' health.

Curriculum Content	**Hours**
Unit I Introduction to HRM. Scope of HRM. Functions and objectives of HRM, HRM Model.	8

Evaluation of HRM. Need of HRD in the context of globalization. Man Management.	
Unit II Human Resource Planning. Nature and Importance of HRP, Factors affecting HRP, Planning Process, Manpower Calculations. Techniques of manpower planning for company projects. Various HRD parameters, functional skills, supervisory skills, Entrepreneurship. Industrial Psychology. Personality Development.	9
Unit III Personnel Management: Concept of Personnel Management, Role and Function of a Personnel Manager. Necessity of Personnel Management. Time Management, leadership. Qualities of a leader. Directing, Decentralizing, Delegation, Departmentalization and Division of Labour. Decision making. Communication skills. Coordinating and Controlling. Quality Control.	9
Unit IV Recruiting Human Resources: Nature, purpose and importance of recruitment, factors governing recruitment, Recruitment process, Selecting Human Resources: Organization for selection, selection process, barriers to effective selection, selection in India. Right Man for the Right Job. Inducting and placing: Evaluation of Orientation programmes, Problems of orientation, typical orientation programme. Team Work and its importance. Corporate expectations from its employees.	9
Unit V Training: Nature of training and development, Inputs in training and development, gaps in training, the training process in various construction companies. Impact of practical Training. Human Relations. Remuneration: Remuneration of Personnel. Factors influencing employees' remuneration, various methods of deciding the remuneration wage policy in India. Job evaluation, Job Satisfaction, Job Rotation, Job Enrichment. Performance appraisal and Merit rating. Success of a corporate leader. Success of an Organization.	9
Unit VI Motivation and Perspective: Motivation, importance of motivation, theories of motivation, Theories of Motivation and their comparison, Motivation as an incentive. Strong point of a person. SWOT Analysis. Promotion. HRM and IHRM. Managing international HR activities, Labour laws, Labour Legislation. Employees' health.	8

Suggested Text Books:	
1.	Human Resource Management - Text and Cases, K Aswathappa, Sadhna Dash, 9th Edition, McGraw Hill Publication
2.	Human Resource Management- Gary Dessler & Biju Varrkey, Pearson Publication
3.	Administrative and Human Resource Solutions for Construction Projects - PremVardhan, Notion Press

Suggested Reference Books:	
1.	Human Resource Management in Construction: Critical Perspectives - Andrew Dainty (Editor), Martin Loosemore, Routledge Publisher
2.	Human Resources Management in Construction – A.W. Gale, Routledge Publisher
3.	The HR Answer Book: An Indispensable Guide for Managers and Human Resources Professionals - Shawn Smith and Rebecca Mazin, AMACOM Publisher
4	Monappa A, "Personnel Management", Tata McGraw Hill, New Delhi, 1997.
5	NICMAR Publication on - HRD in the Construction Industry - papers andproceedings of the 5th National HRD round table in the Construction Industry, Pune - March - 2000.
6	William J Bruns Jr. "Performance Measurement, Evaluation and Incentives",Tata McGraw Hill.
7	Rao T, "HRD in the New Economic Environment", Tata McGraw Hill.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**ELECTIVE-I TRANSPORTATION INFRASTRUCTURE PLANNING AND DEMAND ESTIMATION**			***Course Code*:**	**:**	CE 431
Teaching Scheme (Hours)	**:**	Lecture :	4 hours/weeks		***Total Credits***	**:**	**04**
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 315, CE 323					
Course Domain	**:**	Elective					

Course Rationale: *The course introduces the recent advancements in the field of Sustainable Urban Development, Traffic Engineering and Management, Systems Dynamics Approach to Transport Planning, Highway Design and Construction, Economic and Environment Evaluation of Transport Projects.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To introduce the students with the principles and practice of transportation engineering this focuses on Traffic and Transportation Engineering and Highway Engineering.	1.	The students after completion of this course will have an in-depth knowledge in Traffic Engineering, Transport Planning, Highway Design and Construction, Sustainable Urban and Transport development and will be efficient enough to take up projects in the field.
2.	To introduce the recent advancements in the field of Sustainable Urban Development, Traffic Engineering and Management, Systems Dynamics Approach to Transport Planning, Highway Design and Construction, Economic and Environment Evaluation of Transport Projects.	2.	As the students have a hands-on experience in working with the Software, live projects, field visits to various organizations and training sessions during the course of study, they will be fully fledged Transport and Highway Planner.
3.	To strengthen the student's knowledge and technical knowhow to be efficient Transport Engineers.	3.	Student will gain knowledge about efficient Transportation.

Curriculum Content	**Hours**
Unit I **Introduction:** Infrastructure and its role in developing society; Transport sector in India – policy framework; development plans – Airports, Highways – National Highway development Program (NHDP); JNNURM, Project development Process. **Infrastructure Planning:** Systems Engineering Approach to Transportation Planning; Inter dependence of Land Use and Transportation; Urban vs. Rural Transportation Needs; Transportation System Evaluation Process (Demand and Supply equilibrium); Deficiency Analysis; Stages of Project Planning and Stakeholders	07

Unit II **Traffic Characteristics:** Traffic characteristics – Road user characteristics, General human characteristics, physical characteristics. Vision eye – movement peripheral vision, Visual attention, visual sensitivity to light and colour, glare vision and recovery perception of space. Hearing, Stability sensation, Time factor in response, Theory of PIEV modifying factors, conditional responses; Vehicular Characteristics –types, dimensions, resistance, power requirement for different resistance, change in direction – minimum turning radius, off tracking, slip angle.	08
Unit III **Traffic and Transportation Surveys:** Project data needs assessment; Identification of Project Influence Area; Zoning Principles; Primary and Secondary data; Data Collection and Sampling Techniques; Traffic Surveys – Planning and Questionnaire Design; Inventory of Transport Facility; Sources of Secondary Data.	08
Unit IV **Traffic Parameter Studies and Analysis:** Objectives and Method of Studies, Traffic Studies - Volume, Speed, Travel Time, Capacity and Intersection survey and analysis, Parking and Accident studies.	08
Unit V **Travel Demand Estimation and Forecasting:** Characteristics of Highway Travel Demand, Urban (Public and Private Transport) Travel Demand; Principles of Travel Demand Estimation and Forecasting; 4-stage Travel Demand Modelling; Category analysis; Applications. **Traffic Management:** Elements of Traffic Management Plan; Urban Traffic Management, Arterial Road Traffic Management Measures; Traffic Signal Designs; Design of Intersections and Rotary; Traffic Management at Construction Site.	12
Unit VI Intelligent Transport System: Technology oriented systems area – Advanced traffic management system, traveler information system and vehicle control system; Application oriented systems area – Advanced public transport system, commercial vehicle operation and rural transport system, benefits of ITS. Case Studies on Urban Transportation Plans for medium sized cities; Traffic Forecasting for Highways; Public Transit Demand Forecasting	09

Suggested Text Books:	
1.	Kadiyali L.R. and N.B. Lal, "Principles and Practice of Highway Engineering (Including Expressways and Airport Engineering)", Khanna Publishers, New Delhi. (2004)
2.	Pignataro L.J., "Traffic Engineering: Theory and Practice", Prentice-Hall Inc., New Jersey. (1973)
Suggested Reference Books:	
1.	Black John, "Urban Transportation Planning", Croom Helm Ltd. London. (1981)
2.	BPR Urban Transportation Planning: General Information and Introduction to System, Bureau ofPublic Roads, Washington D.C. (1970)
3.	Bruton M.J., "Introduction to Transportation Planning. II", Edn. Hutchinson, London(1975)
4.	Drew D.R., "Traffic Flow Theory and Control", McGraw-Hill, New York. (1968)
5.	Hutchinson B.G., "Principles of Urban Transport Systems Planning", McGraw-Hill Book Co., NewYork. (1974)

6.	Kadiyali L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi. (1994)
7.	McShane W.R. and Roess R.P., "Traffic Engineering", Prentice-Hall Inc., New Jersey(1990)
8.	Partha Chakroborty and Animesh Das, "Principles of Transportation Engineering, Prentice-HallIndia, New Delhi. (2003)
9.	Putman S.H., "Integrated Urban Models", Pion Ltd., London. (1983)
10.	Wilson A.G., "Entropy in Urban and Regional Modelling", Pion Ltd., London(1970)
11.	Wells G.R., "Traffic Engineering – An Introduction", Griffins, London. (1970):
12.	Wohl M. and Martin B.V., "Traffic System Analysis of Engineers and Planners", McGraw-HillBook Co., New York
13.	www.nhai.org

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**ELECTIVE-I WATERSHED MANAGEMENT**			***Course Code*:**	**:**	CE 432
Teaching Scheme (Hours)	**:**	Lecture :	4Hrs/week		***Total Credits***	**:**	04
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total = 100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 322, CE 414					
Course Domain	**:**	Elective					

Course Rationale: The course includes sustainable and integrated watershed management and its social aspects and study watershed modeling and use of modern techniques in watershed management.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To study sustainable and integrated watershed management and its social aspects	1.	Understand sustainable and integrated watershed management and its social aspects.
2.	To study watershed modeling and use of modern techniques in watershed management.	2.	Understand watershed modeling and use of modern techniques in watershed management.
3.	To study flood, drought and water quality management.	3.	Understand study flood, drought and water quality management.

Curriculum Content	**Hours**
Unit I **Introduction and Basic Concepts:** Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making. **Sustainable Watershed Approach and Watershed Management Practices:** Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, soil erosion and conservation; watershed management practices in arid and semiarid regions, case studies, short term and long-term strategic planning.	8
Unit II **Integrated Watershed Management:** Introduction to integrated approach, integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system. **Social Aspects of Watershed Management:** Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies and Visit to developed water shed	9
Unit III **Watershed Modeling:** Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall-runoff process, subsurface flows and groundwater flow.	9

Unit IV **Management of Water Quality:** Water quality and pollution, types and Sources of pollution, water quality modeling, environmental guidelines for water quality. **Water Conservation and Recycling:** Perspective on recycle and reuse, Waste water reclamation	8
Unit V **Storm Water and Flood Management:** Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage. **Drought Management:** Drought assessment and classification, drought analysis techniques, drought mitigation planning.	9
Unit VI **Use of Modern Techniques in Watershed Management:** Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management.	9
Suggested list of Tutorials and Assignments: At least one assignment on each unit.	

Suggested Text Books:	
1.	Murthy, J.V.S., "Watershed Management", New Age Intl., New Delhi 1998.
2.	Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994
3.	Vir Singh Raj, "Watershed Planning and Management", Yash Publishing House, Bikaner, 2000
Suggested Reference Books:	
1.	Allam, Gamal Ibrahim Y., "Decision Support System for Integrated Watershed Management", Colorado State University, 1994.
2.	American Soc. of Civil Engr., "Watershed Management", American Soc. of Civil Engineers, New York, 1975.
3.	Black Peter E., "Watershed Hydrology", Prentice Hall, London, 1991.
4.	Michael A.M., "Irrigation Engineering", Vikas Publishing House, 1992
5.	Purandare A.P., Jaiswal A.K., "Watershed Development in India", NIRD, Hyderabad, 1995.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**MAJOR PROJECT PHASE-I**			***Course Code*:**	**:**	CEL 415
Teaching Scheme (Hours)	**:**	Practical :	2 Hrs/week		***Total Credits***	**:**	3
Evaluation Scheme (Marks)	**:**	IOE = --	EOE= 50	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	The prerequisite for this course is to possess the fundamental knowledge of Civil Engineering					
Course Domain	**:**	core					

Course Rationale: *The projects help students in different ways like the formation of groups, understanding group behavior, improving communication skills, learning in-depth within minimum time, interaction with the guide and outside agencies and arriving at the best technical solution.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To carry out extensive literature survey on the research topic	**1.**	perform extensive literature survey and identify research topic of work
2.	To identify the problem statement for the research work.	**2.**	identify the problem statement for the research work
3.	To decide methodology for the research work.	**3.**	Decide methodology for the research work.
4.	To carry out initial mathematical modeling or experimental set up.	**4.**	carry out mathematical modeling or experimental program for the proposed work

List of Experiments

Sr. No.	
1.	**Project Topics**: Project topics should preferably be design, development, design aid type and interdisciplinary. The projects should aim at training the students in going through all important phases of project studies starting from establishing the need through collection of data, analysis, design, development, drawing, cost estimates and project reports, where appropriate some alternatives which meet the same needs should also be considered and evaluated using appropriate evaluation criteria.
2.	**Methodology for Project Evaluation:** Project group consists of a minimum THREE and maximum FIVE students. The group is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. During the First Stage of the Project Students would identify a project in area related with engineering and carryout the necessary literature review. Based on the literature review during first stage of the project student would write a report which would give a review of literature, problem formulation and methodology to be adopted. The report would be presented through a seminar which would be evaluated at the end of the term by the panel of internal and external examiners. The Work may consist of the following points: **1.** Problem Formulation **2.** Survey of Literature **3.** Experimental investigation/ Data collection **4.** Design and Fabrication of Model **5.** Industrial Assignment
3.	The assessment of the project will be done at the end of the semester by a committee consisting of three faculty members from the department along with Project Guide. The students will

	present their project work before the committee. A minimum ten-page typed report excluding photographs based on the work done will have to be submitted in prescribed format to the assessing committee. The committee will award the marks to the individual students. One Project Guide shall be allotted maximum TWO groups for guidance. For work load calculation minimum load is 2hr/week, for one group of FOUR to FIVE students. (As per AICTE Guide Lines).

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB-I RCC DESIGN AND DRAWING - I**			***Course Code*:**	**:**	CEL 416
Teaching Scheme (Hours)	**:**	Practical :	2 Hrs/week		***Total Credits***	**:**	1
Evaluation Scheme (Marks)	**:**	IOE: 50	EOE = --	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, ES-11A5, CE 211, CEL 216, CE 221, CEL 229, CE 311 , CE 312, CEL 328					
Course Domain	**:**	core					

Course Rationale:The objective in RCC structure design is to produce a structure capable of resisting all applied loads without failure during its intended life. The objective can be fulfilled by: (i) Understanding the strength and deformation characteristics of concrete and steel, (ii) Following the clearly defined standards for materials, production, workmanship and maintenance, and use of structures in service, (iii) Adopting measures needed for durability.

Course Objectives:The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To prepare detailing of reinforcement of members under various loading conditions	**1.**	Implement the concepts of structural design procedure
2.	To prepare schedule of the reinforcement	**2.**	Design the individual members and hence building as a whole.
3.	To understand behavior of RCC elements under flexure, shear and axial stresses	**3.**	To practice the elementary design of different structural elements

List of Experiments

Sr. No.	List of experiments: (Any 8)
1.	**Design Assignments Shall Consist of Following:** 1. Design of RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group). 2. The drawings would be drafted using Drafting Package/ Auto CAD. Four full size drawing sheets would be drawn using drafting software/ Auto CAD. 3. Bar bending schedule and detailing of reinforcements as per standard professional practice and relevant IS codes. 4. Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects. 5. Design of multistoried RC buildings using software such as STAAD.Pro, STRUD, ETABS, etc. 6. For the architectural layouts necessary for the RCC design assignments, buildings designed for the Laboratory work on Building Design and Drawing and Building Planning would be taken as basis. 7. Report of a site visit related to building structure under construction.
2.	**Design Assignments Shall Consist of Following:** 1. Design of RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group). 2. The drawings would be drafted using Drafting Package/ Auto CAD. Four full size

	drawing sheets would be drawn using drafting software/ Auto CAD. 3. Bar bending schedule and detailing of reinforcements as per standard professional practice and relevant IS codes. 4. Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects. 5. Design of multistoried RC buildings using software's such as STAAD.Pro, STRUD, ETABS, etc. 6. For the architectural layouts necessary for the RCC design assignments, buildings designed for the Laboratory work on Building Design and Drawing and Building Planning would be taken as basis. 7. Report of a site visit related to building structure under construction.
3.	**Design Assignments Shall Consist of Following:** 1. Design of RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group). 2. The drawings would be drafted using Drafting Package/ Auto CAD. Four full size drawing sheets would be drawn using drafting software/ Auto CAD. 3. Bar bending schedule and detailing of reinforcements as per standard professional practice and relevant IS codes. 4. Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects. 5. Design of multistoried RC buildings using software's such as STAAD.Pro, STRUD, ETABS, etc. 6. For the architectural layouts necessary for the RCC design assignments, buildings designed for the Laboratory work on Building Design and Drawing and Building Planning would be taken as basis. 7. Report of a site visit related to building structure under construction
Suggested Text Books/ Reference Books/Manual	
1.	N.C. Sinha and S.K. Roy, "Fundamentals of Reinforced Concrete", S. Chand publications, 4th edition, 2013.
2.	B. C. Punmia, A.K. Jain and A.K. Jain, "Comprehensive Design of R.C. Structures", Laxmi Publications,10th edition, 2015.
3.	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures publications, 8th edition, 2014.
4.	A. K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand and brothers- Roorkee, 7th edition, 2012.
Suggested Reference Books:	
1.	P.C. Varghese, "Limit State Design of reinforced concrete", Prentice-hall of India Pvt. Ltd , 2ndEdition, 2004
2.	M. L. Gambhir and McMillan, "Reinforced Concrete Design", PHI learning Pvt. Ltd, 4thEdition, 2006

Reference Design codes:	
1	IS456-2000: Plain and Reinforced Concrete - Code of Practice
2	IS 13920-2016: Ductile detailing of reinforced concrete structures subjected to seismic forces - code of practice
3	SP 34-1987: handbook on reinforcement and detailing

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB-II STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING**			***Course Code*:**	**:**	CEL 417
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= --	EOE= 50	Total=50	***Duration of EPE***	**:**	---
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, ES-11A5, CE 225, CEL 227					
Course Domain	**:**	Professional Core					

Course Rationale: The laboratory aims to demonstrate the concept of mode shapes, effect of infill during behavior of earthquake, effect of planar asymmetry and liquefaction of soil.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Demonstrate the concept of vibration response to SDOF	**1.**	Understand the concept of vibration response to SDOF
2.	Demonstrate the concept of vibration response to MDOF	**2.**	Understand the concept of vibration response to MDOF
3.	Demonstrate the effect of stiffness of the wall provided in the structures.	**3.**	Understand the effect of stiffness of the wall provided in the structures.
4.	Demonstrate effect of soil liquefaction during earthquake shaking.	**4.**	Understand effect of soil liquefaction during earthquake shaking.

List of Experiments

Sr. No.	The laboratory work should include the following: (Any 8)
1.	Dynamics of a three storied building frame subjected to harmonic base motion
2.	Dynamics of a one-storied building frame with symmetry subjected to harmonic base motion
3.	Dynamics of a one-storied building frame with infill stiffness subjected to harmonic base motion
4.	Dynamics of a one-storied building frame with planer asymmetry subjected to harmonic base motion
5.	Dynamics of a three storied building frame with infill subjected to harmonic base motion
6.	Dynamics of a three storied building frame with and without infill at ground floor subjected to harmonic base motion
7.	Dynamics of structures subjected to liquefaction
8.	Dynamics of one span beam
9.	Dynamics of two span beam
10.	Earthquake induced waves in rectangular tanks

General Instructions: Any 8 experiments should be submitted as laboratory work

Suggested Text Books/ Reference Books/Manual

1.	Hosur V.I., "Earthquake Resistant Design of RCC structures", Willey Publication
2.	Paz Mario, "Structural Dynamics", CBS Publishers and Distributers, 2004
3.	Earthquake Engineering Lab Manual, IISC, Bangalore

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB-III ESTIMATING AND COSTING**			***Course Code*:**	**:**	**CEL418**
Teaching Scheme (Hours)	**:**	Practical :	2 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE= NIL	EOE= 50	Total=50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-12A2, CE213, CE222, CE224.					
Course Domain	**:**	Core					

Course Rationale: To provide the student with the ability to estimate the quantities of item of works involved in buildings, water supply and sanitary works, road works and irrigation works, and also to equip the student with the ability to do rate analysis, fill tenders, prepare contract, valuation of properties and preparation of reports for estimation of various items.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To provide students necessary knowledge and skills in estimation of civil works	**1.**	To Understand concept of estimates and types of estimate for various for Civil Engineering works.
2.	To draft detailed specification and work out rate analysis according to material, labor requirements as per specified norms.	**2.**	To understand Specification if work and Calculate rates for various items of construction.
3.	To understand detailed estimate and BBS.	**3.**	Prepare estimates for various civil engineering works and BBS.
4.	To understand procedure of contracts	**4.**	To prepare actual contract form.
5	To understand procedure of tenders.	**5.**	To prepare and fill tenders.
6.	To carry out valuation of civil engineering structures.	**6.**	Prepare valuation report for residential building.

List of Experiments

Sr. No.	
1.	Writing detailed specifications for items of work from various civil engineering works. (each from Building, Roads, Irrigation works, Water supply and sanitation and sewer from buildings)
2.	Detailed rate analysis for items of work from various civil engineering works. (at least 10 items)
3.	Schedule of reinforcement for the following: Beams, Slab, Staircase, Column and Footing
4.	Preparing detailed estimate for G + 1 building with framed structure. (in a group of 4-5 students with separate plan for each group)
5.	Preparing detailed estimate for civil structures other than building such as Earthwork for road construction, estimate of road/highway works, estimate of steel roof truss, estimate of a culvert, water tank (elevated storage tank).(any one)
6.	Preparing tender notice and schedule 'B' (BOQ) for G + 1 building for which the detailed estimate is prepared.
7.	Preparing tender document for G + 1 building for which the detailed estimate is prepared.
8.	Preparing detailed valuation report for residential/commercial/ industrial building using standard form O-1.
9.	Site Visits

General Instructions:	
Suggested Text Books/ Reference Books/Manual	
1.	Estimating, Costing, Specification & Valuation In Civil Engineering by M. Chakraborti
2.	S.C. Rangwala, "Elements of Estimating and Costing", Charotar Publishing house, 4th edition, 2014.
3.	B.N. Dutta, "Estimating and costing", Dhanpat Rai and sons, 28th edition, 2017.
4.	Valuation of Real Properties by S.C. Rangwala, Ketki B. Dalal, Charotar Publishing house, 9th edition, 2013.
5.	Standard specifications volumes I and II (PWD Maharashtra) Govt. of Maharashtra
6.	CPWD Specifications
7.	CPWD Schedules of Rates
8.	PWD Hand Book and Red Book
9.	PWD Schedule of Rates – Latest
10.	National Building Code of India – Guidelines for regulating the building construction activities.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB IV ELECTIVE-I ADVANCED ANALYSIS OF STRUCTURE**			***Course Code*:**	**:**	CE 433
Teaching Scheme (Hours)	**:**	Practical	2 hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOI = 50	EOE = Nil	Grand Total = 50	***Duration of SEE***	**:**	---
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 211 , CE 221 , CE 312					
Course Domain	**:**	Core					

Course Rationale: The objective in advance analysis of structure is to expose the students to advanced level of structural analysis using special methods of analysis and using relevant software's.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1	To impart the knowledge of advanced methods of structural analysis.	**1**	**Apply** advanced methods for analysis of structures.
2	To provide knowledge for analyzing special types of structures.	**2**	**Calculate** forces and displacements for special structures.
3	To prepare students to develop computer programs by using matrix methods of structural analysis.	**3**	**Formulate** program by using matrix methods of structural analysis for field applications.
4	To impart the knowledge of advanced methods of structural analysis.	**4**	**Apply** advanced methods for analysis of structures.

The laboratory work should include the assignments based on following:

1. Unit 1- Influence line diagrams for indeterminate structure
2. Unit 2- Fixed arches
3. Unit 3- Beam curved in plan
4. Analysis of portal frames
5. Analysis of space trusses by tension coefficient method analysis of secondary stresses in plane frames
6. Beams on elastic foundation
7. Analysis of continuous beams, portal frames, trusses using structural analysis software.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB-IV ELECTIVE-I GREEN BUILDING DESIGN**			***Course Code*:**	**:**	CEL 434
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= 50	EOE= --	Total=50	***Duration of EPE***	**:**	---
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	The prerequisite for this course is to possess the fundamental knowledge of Green Buildings					
Course Domain	**:**	Elective					

Course Rationale: Designing buildings whilst having energy efficiency in mind, is gradually gaining ground for the last few decades. As the future is approaching and the energy production mix is radically changing towards more sustainable sources, it is apparent that energy efficiency will be a driving factor in the construction industry. Hence, to understand energy efficiency the course is included in the syllabus.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To study the building materials and its impact on environment	**1.**	To understand rainwater harvesting methodologies.
2.	To insight into various Energy Efficient materials and Sustainable construction Technology.	**2.**	Understand Active and Passive solar energy systems
3.	To apply the knowledge of Building blocks and Mortars for Masonry in specific site.	**3.**	Design and develop energy efficient building.
4.	To learn the green buildings concepts applicable to alternate design.	**4.**	Apply theory knowledge in practical demonstration.

List of Experiments

Sr. No.	The laboratory work should include the following:
1.	A) Assignment based on All units in Theory.
2.	B) Introduction to green building rating system.
3.	C) Visit to Green Building Site/solar power/rainwater harvesting site.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB-IV ELECTIVE-I HUMAN RESOURCE MANAGEMENT IN CONSTRUCTION**			***Course Code*:**	**:**	CEL 435
Teaching Scheme (Hours)	**:**	Practical :	2 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE=50	EOE= --	Total=50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 315					

Course Rationale: *For a any organization, human resources department plays a critical role in ensuring employees are engaged, fulfilled, and performing to the best of their abilities. Good HRD leads to success of organization. Therefore it is important that students have to learn basics of Human Resource Management.*

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To understand concept of Human Resource Management.	**1.**	Students will be able to determine the practical application of Human resource Management.
2.	To understand the various means of employee handling.	**2.**	Students will be able to determine requirement of human resource, training pattern for employees.
3.	To understand the legal concepts relating to HRM.	**3.**	Students will be able to understand different performance appraisals techniques and variousacts used in India for Human welfare**.**

List of Experiments

Assignment will be based on following topics

1. Introduction to Human Resource Management in Global Perspective.
2. Skills and parameters in analysis of Human Resource Management.
3. Personnel Management and its perspective in Construction Engineering.
4. Process of Recruitment in Construction sector based on various factors.
5. Importance of Induction and its processes.
6. Importance of Training and its relevance in Construction sector.
7. Remuneration defining and role of appraisal in one's career growth.
8. Understanding International Human Resource Management.
9. Legal concepts relating to Human Resource Management.
10. A report based on Human Resource Management system implemented at a particular organization.

Suggested Text Books/ Reference Books/Manual

1.	Human Resource Management - Text and Cases, K Aswathappa, Sadhna Dash, 9th Edition, McGraw Hill Publication
2.	Human Resource Management- Gary Dessler & Biju Varrkey, Pearson Publication
3.	Administrative and Human Resource Solutions for Construction Projects – Prem Vardhan, Notion Press
4.	Human Resource Management in Construction: Critical Perspectives - Andrew Dainty (Editor), Martin Loosemore, Routledge Publisher

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB-IV ELECTIVE-I WATERSHED MANAGEMENT**			***Course Code*:**	**:**	CEL 436
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= 50	EOE= --	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 322, CE 414					
Course Domain	**:**	Elective					

Course Rationale: *The course consist of Watershed Management Practices on site, Watershed Management Practices on site and to manage flood and drought condition at site.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To study various Watershed Management Practices on site	**1.**	study various Watershed Management Practices on site
2.	To carry out watershed modeling of selected site	**2.**	carry out watershed modeling of selected site
3.	To study how to manage flood and drought condition at site	**3.**	manage flood and drought condition at site

List of Experiments

Sr. No.	The laboratory work should include the following:
1.	At least one Assignment based on each unit
2.	Site Visit containing study of following points:
3.	Implementation of Watershed Management Practices in selected site region
4.	Watershed modeling of selected site
5.	Use of modern techniques in watershed management at selected site
6.	Flood Management or drought management in selected area
7.	Water quality management in selected site area

Suggested Text Books

1.	Murthy, J.V.S., "Watershed Management", New Age Intl., New Delhi 1998.
2.	Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994
3.	Vir Singh Raj, "Watershed Planning and Management", Yash Publishing House, Bikaner, 2000

Suggested Reference Books:

1.	Allam, Gamal Ibrahim Y., "Decision Support System for Integrated Watershed Management", Colorado State University, 1994.
2.	American Soc. of Civil Engr., "Watershed Management", American Soc. of Civil Engineers, New York, 1975.
3.	Black Peter E., "Watershed Hydrology", Prentice Hall, London, 1991.
4.	Michael A.M., "Irrigation Engineering", Vikas Publishing House, 1992
5.	Purandare A.P., Jaiswal A.K., "Watershed June 2023in India", NIRD, Hyderabad, 1995.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB IV ELECTIVE-I TRANSPORTATION IN INFRASTRUCTURE PLANNING AND DEMAND ESTIMATION**			***Course Code*:**	**:**	CEL 437
Teaching Scheme (Hours)	**:**	Practical :	02- Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE= 50	EPE/EOE= -	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 315, CE 323					
Course Domain	**:**	Elective					

Course Rationale: *The course includes the recent advancements in the field of Sustainable Urban Development, Traffic Engineering and Management, Systems Dynamics Approach to Transport Planning, Highway Design and Construction, Economic and Environment Evaluation of Transport Projects.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To introduce the students with the principles and practice of transportation engineering this focuses on Traffic and Transportation Engineering and Highway Engineering.	**1.**	The students after completion of this course will have an in-depth knowledge in Traffic Engineering, Transport Planning, Highway Design and Construction, Sustainable Urban and Transport development and will be efficient enough to take up projects in the field.
2.	To introduce the recent advancements in the field of Sustainable Urban Development, Traffic Engineering and Management, Systems Dynamics Approach to Transport Planning, Highway Design and Construction, Economic and Environment Evaluation of Transport Projects.	**2.**	As the students have a hands-on experience in working with the Software, live projects, field visits to various organizations and training sessions during the course of study, they will be fully fledged Transport and Highway Planner.

List of Experiments

Assignment will be based on following topic

1. Infrastructure Planning
2. Traffic Characteristics
3. Traffic and Transportation Surveys
4. Traffic Parameter Studies and Analysis
5. Travel Demand Estimation and Forecasting
6. Traffic Management
7. Intelligent Transport System

Suggested Text Books

1.	Kadiyali L.R. and N.B. Lal, "Principles and Practice of Highway Engineering (Including Expressways and Airport Engineering)", Khanna Publishers, New Delhi. (2004)
2.	Pignataro L.J., "Traffic Engineering: Theory and Practice", Prentice-Hall Inc., New Jersey. (1973)

Suggested Reference Books:	
1.	Black John, "Urban Transportation Planning", Croom Helm Ltd. London. (1981)
2.	BPR Urban Transportation Planning: General Information and Introduction to System, Bureau ofPublic Roads, Washington D.C. (1970)
3.	Bruton M.J., "Introduction to Transportation Planning. II", Edn. Hutchinson, London(1975)
4.	Drew D.R., "Traffic Flow Theory and Control", McGraw-Hill, New York. (1968)
5.	Hutchinson B.G., "Principles of Urban Transport Systems Planning", McGraw-Hill Book Co., New York. (1974)
6.	Kadiyali L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi. (1994)
7.	McShane W.R. and Roess R.P., "Traffic Engineering", Prentice-Hall Inc., New Jersey (1990)
8.	Partha Chakroborty and Animesh Das, "Principles of Transportation Engineering, Prentice-Hall India, New Delhi. (2003)
9.	Putman S.H., "Integrated Urban Models", Pion Ltd., London. (1983)
10.	Wilson A.G., "Entropy in Urban and Regional Modelling", Pion Ltd., London(1970)
11.	Wells G.R., "Traffic Engineering - An Introduction", Griffins, London. (1970).
12.	Wohl M. and Martin B.V., "Traffic System Analysis of Engineers and Planners", McGraw-Hill Book Co., New York
13.	www.nhai.org

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**INTERNSHIP III**			***Course Code*:**	**:**	CEL 419
Teaching Scheme (Hours)	**:**	Practical :	-- Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= 50	EOE= --	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core					

Course Rationale*: Internship exposes the students to actual working environment. It will enhance their knowledge and skill from what they have learned in the academic. It will improve administrative ability, responsibility and self-confidence.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To expose the students to actual working environment.	**1.**	Relate engineering knowledge and understand field practices in civil engineering.
2.	To enhance their knowledge and skill from what they have learned in the academic.	**2.**	Correlate theoretical concepts with practical implementation.
3.	To instill the good qualities of integrity, responsibility and self-confidence.	**3.**	Acquire report preparation skill and work as an individual and team.

List of Experiments

Sr. No.	
1.	**ASSESSMENT ON VACATION FIELD TRAINING (4 WEEKS)** The students are required to undergo rigorous field training for summer vacation for minimum of 4 weeks in any of the Civil Engineering Projects/Firms to have an exposure to practical aspects. Student shall submit a report on field training and give presentation in front of Civil Engineering Program committee based on training for the final internal oral evaluation.
2.	**The Report Should Consist:** **1.** Introduction and Brief History of the Organization **2.** Technical and Practical information gained during the summer training period **3.** Daily Material Consumption Report **4.** Daily Work Progress Report **5.** Daily Muster of Labors on Site **6.** Safety Measures

Class & Semester	:	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**									
Course Title	:	**INTRODUCTION TO CONSTITUTION OF INDIA**						***Course Code*:**	:	AC 416	
Teaching Scheme (Hours)	:	Lectures= 2 hr /Week						***Credits***	:	Nil	
Evaluation Scheme (Marks)	:	Assignments Viva voce	: :	50 25	Written Test Grand Total	: :	25 100	***Duration of Exam***	:	Not Applicable	
Revision	:	Second						***Month***	:	June 2023	
Pre-requisites	:	It has no any pre-requisites. Every citizen of the country ought to study the course content.									
Course Domain	:	Audit Course at institute level , Humanities & Social Science									

Course Rationale: *As a citizen of India, every student should have basic knowledge about Indian constitution. Every student should know the importance of Fundamental rights, Fundamental duties as well as Directive Principles. This course fulfills all these requirements. This course also includes knowledge about state as well as union legislature, judiciary and executive. It helps to understand emergency provisions, electoral process and amendment procedures. This course is helpful for the students to be legally updated.*

Course Objectives: The Course Teacher will		***Course Outcomes:*** Students will be able to	
1.	Familiarize students with the preamble	**1.**	Get associated with Indian Constitution
2.	Describe fundamental rights & duties of citizens	**2.**	Understand their fundamental duties and rights.
3.	Explain union and state executives.	**3.**	Recognize union and state executives.
4.	Discuss constitutional provisions.	**4.**	Interpret about constitutional provisions.
5.	Illustrate electoral process.	**5.**	Understand and follow the electoral process
6.	Summarize role of democracy in social welfare.	**6.**	Realize importance of democracy in social welfare.

Curriculum Content	**Hours**
Unit I: Introduction to Preamble and Fundamental Rights Preamble to the constitution of India. Fundamental rights under Part – III – details of Exercise of rights, Limitations & Important cases.	**04**
Unit II: Fundamental Duties and Directive Principles. Relevance of Directive principles of State Policy under Part – IV. Fundamental duties & their significance.	**04**
Unit III: Union Legislature, Judiciary & Executive. President, Prime Minister, Parliament & the Supreme Court of India.	**04**
Unit IV: State Legislature, Judiciary & Executive. Governors, Chief Minister, State Legislator and High Courts.	**05**
Unit V: Constitutional Provisions. Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes. Emergency Provisions.	**04**
Unit VI: Electoral process & Amendment procedures: Constitution of election commission,	**05**

system of adult suffrage, procedure for amendment.42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments.	

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India" (Students Edn.) Prentice – Hall EEE, 19th/20th Edn. 2001.
2. R.C.Agarwal, "Indian Political System", (1997) S.Chand and Company, New Delhi. Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi.
3. K.L.Sharma, "Social Stratification in India: Issues and Themes", (1997), Jawaharlal Nehru University, New Delhi.

Reference Books:

1. An Introduction to Constitution of India" by M.V. Pylee, Vikas Publishing, 2002. Sharma, Brij Kishore, "Introduction to the Constitution of India: Prentice Hall of India, New Delhi.
2. U.R.Gahai, "(1998) Indian Political System ", New Academic Publishing House, Jalandhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, "(1997) Social Stratification and Charge in India ", Manohar, New Delhi.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**DESIGN OF CONCRETE STRUCTURES- II**			***Course Code*:**	**:**	CE 421
Teaching Scheme (Hours)	**:**	Lecture :	03 hr/week		***Total Credits***	**:**	04
		Tutorial :	01 hr /week				
Evaluation Scheme (Marks)	**:**	CIE = 30 (20 +10)	SEE = 70	Grand Total = 100	***Duration of SEE***	**:**	4 hrs.
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 221, CE 223, CE 312					
Course Domain	**:**	Core					

Course Rationale: *The objective in RCC structure design is to produce a structure capable of resisting all applied loads without failure during its intended life. The objective can be fulfilled by: (i) Understanding the strength and deformation characteristics of concrete and steel, (ii) Following the clearly defined standards for materials, production, workmanship and maintenance, and use of structures in service, (iii) Adopting measures needed for durability.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1	To illustrate basic concepts and systems of prestressing.	**1**	**Estimate** losses of prestress due to various causes.
2	To impart knowledge of Prestressed concrete structures.	**2**	**Verify** appropriate section using flexure, shear, torsional design approach for prestressed concrete structures
3	To provide knowledge for design of Prestressed concrete structures using relevant IS codes.	**3**	**Design** various structural RC elements like beam, column, footing, walls and water tanks under different service loads using relevant codes.
4	To understand structural behavior of RCC elements like retaining wall, combine footing, water tanks under flexure, shear and axial stresses.	**4**	**Prepare** the structural drawing of various RCC elements using the guidelines in design codes.

Curriculum Content	**Hours**
Unit I:Prestressed concrete design Basics of pre-stressed concrete, stress concept, strength concept and load balancing concept, systems of prestressing, loss of pre-stress, Material properties: steel, allowable stresses, relaxation, fatigue. Stages of prestressing. Analysis of rectangular sections under flexure at ultimate loads: equations of equilibrium and compatibility and constitutive models, stress block for concrete, solution procedure, minimum and maximum amount of prestressed reinforcement.	8
Unit II- Prestressed concrete design of continuous beam Prestressed concrete design: Cantilever beams and Continuous beams, Cantilever beams: choice of cable profile, determination of limiting zone. Continuous beams: advantages and disadvantages, choice of cable profile, analysis for bending moment. Principle of linear transformation, principle of concordant cable.	8

Unit III: Design of multistoried RC building Design of multistoried building under gravity and lateral loads using relevant design code provisions.	8
Unit IV- RC retaining wall Design of cantilever and counter fort retaining wall with and without surcharge loads.	6
Unit V- Combined footing Design of combined footings: Proportioning of footing, soil bearing pressure. Rectangular footing and Trapezoidal shape footing.	5
Unit VI- RC water tank Design of tank walls resting on ground. Rigid and flexible joints, base slab, design guidelines in IS3370 code.	4

Suggested list of Tutorials and Assignments:

Assignment 1: Design of prestressed concrete beam
Assignment 2: Design of continuous prestressed concrete beam
Assignment 3: Design of retaining wall
Assignment 4: Design of combine footing
Site visit : Site visit report

General Instructions: Site visit will be organized to see the reinforcement detailing. Student has to submit the detail report of each visit.

Suggested Text Books:	
1.	Krishna Raju N., "Advanced Design of Structures", 6th edition, McGraw Hill Education.
2.	Lin T. Y., "Design of Prestressed Concrete Structures", 3rd edition, Wiley India Private Limited
3.	Roy and Sinha, "Design of R. C. Structures", S. Chanda and Co., New Delhi.
4.	Shah V.L. and Karve S.R., "Design of Multistoried Buildings (G+3)", Structures publications, Pune.
Suggested Reference Books:	
1	P.C. Varghese, "Limit State Design of reinforced concrete", Prentice-hall of India Pvt. Ltd, 2ndEdition, 2004.
2	M. L. Gambhir and McMillan, "Reinforced Concrete Design", PHI learning Pvt. Ltd, 4thEdition,2006.
Reference Design codes:	
1.	IS 456 (2000), Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi
2.	IS:1893 (2016), Indian Standard Criteria For Earthquake Resistance of Structures (Part I): General Provisions and Building (Sixth Revision), Bureau of Indian Standards, New Delhi
3.	I.S. 875- Part3 (2015), Design loads (other than earthquake) for buildings and structures, Bureau of Indian Standards, New Delhi
4.	IS 3370-2(2009), Concrete structures for storage of liquids — Code of practice, reinforced concrete structures, first revision, bureau of Indian standards, New Delhi

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**CONSTRUCTION PRACTICES**			***Course Code*:**	**:**	CE 422
Teaching Scheme (Hours)	**:**	Lecture : 03 Hrs/week Tutorial : -- Hrs/week			***Total Credits***	**:**	03
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 213					
Course Domain	**:**	Core					

Course Rationale: *The course deals with various techniques used in construction projects.This course aims to understand students to manage appropriate no. of equipment on the site. It also aware students about the safety measures to prevent accidents on the construction site and aware about disaster management. It also aware the students about advanced construction techniques.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain construction planning of a Civil Project.	1.	Understand construction planning of a Civil Project.
2.	Describe earth-moving equipment and illustrate to determine selection of right machine for the right job.	2.	Understand various earth-moving equipment determine selection of right machine for the right job.
3.	Explain excavation techniques in hard rock	3.	Understand the excavation techniques used for hard rock.
4.	Aware the students aboutconstruction methods adopted for construction of diaphragm walls, erection of steel structures, roads, etc.	4.	Acquainted with construction methods adopted for construction of diaphragm walls, erection of steel structures, roads, etc.
5.	Describe the safety measures to prevent accidents on the construction site and aware about disaster management.	5.	Understand the safety measures to prevent accidents on the construction site and know about disaster management.
6.	Build knowledge among the students about advanced construction techniques.	6.	Know about advanced construction techniques.

Curriculum Content	**Hours**
Unit I Introduction - Conceptual planning of new project, site access and services, Mechanical v/s Manual construction Excavation in Earth: Earth moving equipment's - Tractors, Bulldozers, Scrappers, Power shovel, Hoes, simple numerical problems based on cycle time and production rates.	7

Unit II Excavation in Earth: Drag line, Clamshell, Trenchers, Compactors- types and performance, operating efficiencies, lifting capacities, Floating and dredging equipment.	6
Unit III Excavation in hard rock: Rippers, jack hammers, drills, Blasting explosives, detonators, fuses, Drainage in excavation – necessity and methods of dewatering	6
Unit IV Diaphragm Walls – Purpose and Construction Methods, Piles and Pile driving equipment, Steel construction: Planning and field operations, Lifting Equipment: Cranes, Slip formwork, Asphalt mixing and batching plant (Hot mix plant), Sensor Paver for rigid roads, Crushing plants, Concreting Equipment.	7
Unit V a) Safety measures in construction, prevention of accidents b) Introduction to Disaster management c) Rehabilitation and Strengthening of Structures	7
Unit VI 3D printing technique in civil construction work, Application of Artificial Intelligent in the field of Civil Engineering	6

Suggested list of Tutorials and Assignments:

At least one assignment on each unit.

Suggested Text Books:

1.	Peurifoy R.L .,"Construction, Planning, Equipment and methods", McGraw hill book co New Delhi.
2.	Stubbs, "Hand Book of Heavy Construction", McGraw Hill Inc, 1971
3.	Wedel, "Concrete Construction Hand Book", McGraw Hill Higher Education; 2nd edition,1974

Suggested Reference Books:

1.	Singh Jagman, "Heavy Construction – Planning, Equipment and methods", Oxford and IBH publishers, New Delhi 9.
2.	Prof. Ataev S. S., "Construction Technology", Mir Publishers, Mascow.
3.	Baron Thomas, "Erection of Steel Structures".
4.	Day, "Construction Equipment Guide".
5.	Boyes R.G.H., "Structural and cut off Diaphragm walls", Applied Science Publishers Ltd., London.
6.	Varma Mahesh, "Construction Equipment", Metropolitan book Co., New York.
7.	Hajnal I, I Marton, F. Regele A. Wiley, "Construction of Diaphragm Walls", Inter-science Publication, John Wiley and Sons.
8.	Quin, "Planning and Construction of Docks and Harbors"

Class & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title		**TOWN AND COUNTRY PLANNING**			***Course Code*:**	**:**	CE 423
Teaching Scheme (Hours)	**:**	Lecture :	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE= 30 (20+10)	SEE = 70	Grand Total= 100	***Duration of SEE***	**:**	3 hrs
Revision:		Second			***Month***	**:**	June 2023
Pre-requisites	**:**	ES-11B2					
Type of Course	**:**	Theory					
Course Domain	**:**	Core					
Skills Imbibed	**:**	Cognitive, Affective domain, Psychomotor					

***Course* rational**: *Town and country planning is the process aimed at the well-being of people through controlled allocation of land and creating an urban landscape where transportation and communication networks come together to safeguard and improve the environment. Town and country engineers are responsible for planning and developing modern cities that help improve society at large.*

Course Objectives:		***Course Outcomes***	
1.	To discuss the applications of Principles of Town and Country planning with essential attributes.	1.	Aware about the applications of Principles of Town and Country Planning.
2.	To provide information of various aspects involved in Town and Country Planning.	2.	Identify elements of planning and regulations of the same
3.	To make students familiar with various standards, acts, laws and guidelines.	3.	Understand various concepts of Town and Country Planning.
4.	To provide the knowledge of Town and Country Planning.	4.	Implement guidelines provided by standard authorities of town planning.

Curriculum Content:	**Hours**
Unit 1 **1.1 Town planning Principles** General - evolution of planning - objects of town planning - Economic justification for town planning, principles of Town Planning - Necessity of town planning - origin of towns - growth of towns -stages in town development - personality of town - Distribution of land uses - Forms of planning - site for an ideal Town Requirements of new Towns - Planning of the modern Town - Powers required for enforce T.P. Schemes - cost of Town planning-present position of Town Planning in India. **1.2 Surveys** General - Necessity - collection of Data - Types of surveys - Uses of surveys. **1.3 Zoning** Meaning of the term - Uses of land – objects - principles of Zoning - Advantages of Zoning - Importance of Zoning - Aspects of Zoning - Transition Zone - Economy of Zoning - Zoning powers - Maps for Zoning.	6
Unit 2 **2.1 Housing**	

General - Importance of housing - Demand for houses - Building site - Requirements of residential buildings Classification of residential buildings - Design of residential areas - Rural Housing - Agencies for Housing Investment in housing – HUDCO – CIDCO - Housing problem in India. **2.2 Slums:** General - Causes of slums - Characteristics of slums - Effects of slums - Slum clearance - Works of improvement Open plot scheme - Slum clearance and rehousing -Prevention of slum formation - Resources for slum clearance programmes - The Indian slum.	7
Unit 3 **3.1 Public buildings:** General - Location of Public Buildings – Classification of public Buildings - Principles of design of public buildings - Town centres - Grouping of public buildings - Civic aesthetics. **3.2 Parks and play grounds:** General - Types of recreation - Location of urban green spaces - classification of parks - park system spark design - Finance of parks – parkways – playgrounds -space standards - Landscape architecture. **3.3 Master plan:** General – Objects – Necessity - Data to be collected - Drawings to be prepared - Features of master plan Planning standards – Report - stages of preparation - Method of Execution - conclusion. **3.4 Re-planning existing towns:** General - Objects of re-planning - Defects of existing towns - Data to be collected - Urban renewal projects Decentralization - Garden city - Surface Drains - Refuse of Town.	6
Unit 4 **4.1 Urban roads:** General – Objects - Requirements of good city road - Factors to be considered - Classification of urban roads. Types of street systems - Through and By - pass Roads - Outer and inner ring roads – Expressways Freeways Precincts - Road aesthetics. **4.2 Traffic management:** General – Object - Traffic survey - Traffic congestion - Traffic control - Road junction – Parking –Traffic capacity of road - Road traffic problems – Road accident - Traffic signal – Road sign –Road marking Street lighting in a town – Traffic problem of existing towns – Peculiarities of traffic.	7
Unit 5 **5.1 Building bye-laws:** General - Objects of bye – laws - importance of bye – laws - Function of local authority - Responsibility of owner Applicability of bye-laws – set-back - Light Plane - Floor space index- Off-street parking - Fire protection Minimum plot sizes - Some other terms -Principles underlying building bye – laws - Building bye - laws for residential area of a typical town planning scheme - Building bye-laws- development control rules General rules of metropolitan Area - CMDA rules. **5.2 Miscellaneous topics:** Airports – Location – size - Noise Control - Parts of an airports - Betterment and compensation - city blocks conurbations Cul-de-sac streets - Focal Point - Green Belt -Public utility services - Rapid transit –Remote sensing application –urban planning using remote sensing - site suitability analysis - Transportation planning.	6
Unit 6 Different town planning works with reference to M.R.T.P. Act. (Brief idea about various Provisions) Land acquisition act – necessity and procedure of acquisition.	

village planning- Planning process, Multilevel planning, Decentralization concepts, Rural developments - planning methodology, Growth centre approach, Area development approach, Integrated rural development approach.		7
Suggested Text Books:		
1.	Hiraskar G.K. "Fundamentals of Town Planning", DhanpatRai and Sons, Delhi.	
2.	Modak N.V. and V.N. Ambdekar, "Town and Country Planning and Housing", Orient Longman Ltd., New Delhi.	
3.	Sundaram K.V. (1978) "Urban and Regional Planning in India", Vikash Publishing House Pvt. Ltd.	
4.	Misra S. N. (1984) "Rural Development Planning-Design and Method", Satvahan Publications, N. Delhi	
Suggested Reference Books:		
1.	John Rate life, "An Introduction to town and country planning", London.	
2.	Rangwala K. S. and Rangwala P. S., "Town Planning ", Charotar Publishing House,15th Edition, 1999.	
3.	Ramegowda K A., "Urban and regional planning", University of Mysore.	
4.	National Building Code of India- Part-III.	
5.	Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws.	
6.	Time saver standards for site planning, Mc Graw Hill Book company.	
7.	The art of home landscaping, Mc Graw Hill Book company.	
8.	Harvey M. Rubenstain , "A Guide to site and Environmental planning", New York.	
9.	Michael Hord, "Remote sensing methods and application", John Wiley and Sons, New York, 1986.	
10.	MRTP Act 1966 & 2002	
11.	Land Acquisition Act - 1894	

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering) Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-II ADVANCED DESIGN OF STRUCTURES**			***Course Code*:**	**:**	CE438
Teaching Scheme (Hours)	**:**	Lecture :	4 hr./week		***Total Credits***	**:**	04
		Tutorial :					
Evaluation Scheme (Marks)	**:**	CIE = 30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs.
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 221 , CE 223, CE 311, CE 312,					
Course Domain	**:**	Elective					

Course Rationale: *The objective in advance design of structure is to expose the students to advanced level of structural analysis and design using special methods of analysis and using relevant software's.*

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To understand behavior of special RC structures under various loadings	1.	**Apply** advanced methods for analysis of structures.
2.	To analyze and design special RC structures	2.	**Calculate** forces and displacements in special structures.
3.	To draft detailing of reinforcement in special RC structures as per IS provisions	3.	**Prepare** structural detailing drawings of special structures.

Curriculum Content	**Hours**
Unit I: Design of flat slab Analysis and design of flat slab, detailing of reinforcement as per Codal provisions	9
Unit II: Design of foundations on soft soil a) Pile foundation- Design of end bearing and friction piles, reinforcement detailing, precast piles, handling stresses, pile cap design. b) Raft Foundation- Types, design for flexure and shear	8
Unit III: Design of concrete shear walls Structural behaviors, analysis and design of walls under gravity and lateral loading, boundary elements, reinforcement detailing as per IS13920-2016 code.	9
Unit IV: Design of overhead water tanks Tank wall: Forces in rectangular and circular shape tank walls, methods of analysis, IS code method- use of moment and shear coefficients for different end conditions. Overheard water tank with flat base, design of staging system.	8
Unit V: Design of Grid slab and circular slab Design of grid floors and circular slab with different support conditions.	9
Unit VI: Yield line theory of slabs Virtual work and equilibrium method of analysis, analysis of different shape slab panels with various support conditions.	9

Suggested list of Tutorials and Assignments: Detail report of site visit

General Instructions: A site visit would be organized to see the reinforcement detailing of above

mentioned structures.	
Suggested Text Books:	
1.	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures publications, 8th edition, 2014.
2.	N Krishna Raju, "Advanced Reinforced Concrete Design", CBS publishers and distributors, 2nd edition, 2010.
3.	Ramamrutham, "Design of Reinforced Concrete Structures", Dhanpatrai and Son's Publication, 9th edition, 1981.
Suggested Reference Books:	
1.	P Purushothaman, "Reinforced Concrete Structural Elements", McGraw- Hill publication,3rd. edition, 2004
2.	G.S. Ramaswamy, " Design and Construction of Concrete Shell Roofs", McGraw- Hill publication, New York, 1968
3	A.K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand and bros. publications, 7th edition, 2012
4	Jain and Jai Krishna, "Plain and Reinforced Concrete–Vol. I and II", Nem Chand Bros. Publication, Roorkee.
5	Taylor C. Pere, "Reinforced Concrete Chimneys",Laxmipublications,7th edition, New Delhi
6	Jones LL and Thomas and Hudson, "Yield Line Analysis of Slabs", Chatto and windus Publisher, London, 1967
7	Design of deep girders, Concrete Association of India
8	Mallick and Gupta, "Reinforced Concrete", Oxford andIBH publishing co. Pvt. Ltd. 6th edition,1996
Suggested Reference Codes:	
1	Codes of Practice IS 456-2000, plain and reinforced concrete
2	IS 3370: code of practice concrete structures for the storage of liquids
3	IS13920-2016
4	SP4-1987

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-II ADVANCED GEOTECHNICAL ENGINEERING**			***Course Code*:**	**:**	CE 439
Teaching Scheme (Hours)	**:**	Lecture :	4 Hrs/week		***Total Credits***	**:**	04
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 313, CE 325					
Course Domain	**:**	Elective					

Course Rationale: *The course is important to acquaint knowledge to determine Safe Bearing Capacity of soil, which is further basis to design the foundation of the structures.*

	Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to
1.	To study foundation and bearing capacity aspects.	1.	Students will be able to plan and execute soil exploration activity.
2.	To study ground improvement techniques.	2.	Student will be able to decide soil parameters for foundation design.
3.	To study foundations on expansive soils.	3.	Student will be able to design foundation for expansive soil.
4.	To study methods of ground improvement.	4.	Student will be able to determine bearing capacity of rock.

Curriculum Content	**Hours**
Unit I **Bearing Capacity and Settlement of Foundation** Bearing Capacity under eccentric loading and moment, bearing capacity of layered soils, Bearing Capacity of Geosynthetic reinforced soil, Bearing Capacity of Rock mass, seismicity, liquefaction, Elastic and consolidation settlement, secondary consolidation, estimation of settlement.	9
Unit II **Introduction to Ground Improvement Techniques** Stabilization, vibro technique, dynamic compaction, Grouting, Band Drain, vertical drains, stone columns, granular piles, sand drains, Prefabricated Vertical Drains (PVD), soil nailing, geosynthetics, case histories of Ground Improvement Techniques.	9
Unit III **Pile Foundation Design** Bearing capacity of piles in C, Φ and C-Φ soils, estimation of pile settlement, laterally loaded pile, Uplift capacity of pile, pile groups, Bearing capacity of pile groups, Settlement of pile group, uplift capacity of pile group – Negative drag on piles.	8
Unit IV **Raft foundations:** Types of rafts, Bearing capacity and settlements of raft, Design consideration and I.S. Code	9

method of analysis	
Unit V **Sheet Pile walls and Cofferdams** Types and uses of sheet piles, design of cantilever sheet pile walls in granular and cohesive soils, anchored bulkhead-free earth support and fixed earth support method-coffer dams-uses-braced and cellular cofferdams.	9
Unit VI **Foundations in Special soils:** Foundation in expansive soil, soft and compressible soils, problems associated with foundation installation- ground water lowering and drainage- shoring and underpinning-different methods-damage and vibrations due to constructional operation	8

Suggested list of Tutorials and Assignments:

At least one assignment on each unit.

Suggested Text Books:	
1.	Dr. B. J. Kasmalkar, "Foundation Engineering", Pune Vidyarthi Griha Prakashan, Pune.
2.	Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, (2010).
3.	B.C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publication.
4.	A.K. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers, 2009.
5.	P.C. Varghese," Foundation Engineering", PHI learning private limited, 2014.
Suggested Reference Books:	
1.	J. E. Bowles, "Foundation Analysis and Design", McGraw-Hill International.
2.	B. M. Dass, "Foundation Engineering", Cengage Learning; 7 edition.
3.	N.V. Nayak, "Foundation Design Manual", Dhanpat Rai and Sons, First Edition.
4.	IS Codes such as, IS:1904 (1986), IS: 6403 (1981), IS: 8009Part I (1986), IS: 12070 (1987).

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part: IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-II DEVELOPMENT ENGINEERING**			***Course Code*:**	**:**	CE 440
Teaching Scheme (Hours)	**:**	Lecture :	04 Hrs/week		***Total Credits***	**:**	04
		Tutorial :	00 Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 Hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Course Domain	**:**	The objective of the course is to prepare an engineering student for professional work in the development sectors, i.e., to work as a development engineer					

Course Rationale: *This course aims to introduce the basic principles of engineering for a developing society such asIndia. It aims to teach students how to study society and its engineering systems, the generation of value, the use of natural resources and the various agents who are involved in this. It also supplements this with basic skills of field-work and of data.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To basic understanding of society and development and the data-sets that surround it.	1.	Determine Household and the development agenda.
2.	The role of agents, professions and value-creation.	2.	Determine The Society and its Organization.
3.	The ability to formulate problems, analyses them into its constituent disciplinary parts, solve and report them for stakeholders.	3.	Understand A Sectorial Engineering System.
4.	The ability to design, conduct and report field-work.	4.	Understand GIS Technology Applications.
5.	A particular discipline of engineering and how it contributes to development.	5.	Understand conduct field work as case study.

Curriculum Content	**Hours**
Unit I **The Household and the development agenda** The Engineer as a change agent**.** The method of Science. The method of engineering. Delivering value by solving societalproblems. Interdisciplinary. The need for design and synthesis. The case-study and the skillsrequired. Organization of the course**.** The household as the basic unit. The needs of the household. Cultural, biological needs. The notion of development as a life of less drudgery, more certainty and more culture. Environmental needs and the development engineering sectors. Development Indices. HDI and OECD indices. The data needed to compute these. Core values of equity, efficiency and sustainability. Paradigms of development. Introduction to the village-level census data. Engineering content in various amenities indices. Agents and Value. How is value created in a household. The peasant and the artisan. Resources and amenities. The employee. The teacher. Various modes of payments. Seasons and history of	**08**

accounting. Knowledge of agents.	
Unit II **The Society and its Organization** The basic divisions - State, Market and Civil Society. The environment. Assets and institutions. The environment -land, air, water. Attributes-cultural and as a resource. Pollution. Demands of people and other members of the biosphere. Pollution and sustainability. The structure of the State. The center and the state. The District Collector and the district planning committee. The district and sub-district hierarchy. Various departments. The hierarchy of elected repress Production. The factory and its history. Factors of production-capital, labour and technology. Operations-energy, depreciation, rents, regulation, market access. The small producer and the ecosystem. The Market. The notion of money. Loans and repayments and the role of capital. Money transaction vs. seasonal transactions and others based on trust. The anonymity and instanteity of money. corporation. entatives. The 5-fold layering of engineering as development engineering, informal India, Make by India, Make for India and finally the global Make in India. Matching cultural and manpower layers. Appropriate technology.	**08**
Unit III **A Sectoral Engineering System.** **Example: Irrigation Water.** The geography of Sinnar Taluka and its irrigation systems. Listing stakeholders, i.e., villages farmers, people with and without land, local industrial workers, agriculture-cash crops andtraditional crops, irrigation department and the market. Description of the engineering assets. Key environmental and scientific variables such as crop data, reservoirs and irrigation schedules,soils and rainfall. Agents and their interactions and key decisions on rotations, cropping pattern.Key transactions and decisions.The planning framework and its representation. Stocks and flows. Measuring supply parameters, demand parameters and allocations. Key infrastructure and institutions and their role. Allocationregimes and the connection with development paradigms. History of irrigation for the region. Beale's report and design objectives. Protective vs. commandirrigation and its consequences. Reading the Jal Yukta Shivar GR. Developing a methodology forassessment. An example of a design document. Socio-Technical challenges-increasing irrigated area, drip irrigation and better farm practices.Groundwater regulation. Collective vs. Individual solutions.To an irrigation system. Meeting with an NGO, farmers, a state officer and an elected Representative. **OR** Any choose another one sector from civil engineering program like study of Piped Drinking Water Scheme, Water Supply Schemes, Wastewater, Solid waste management, Public Transport Analysis, Water Audit etc.	**09**

Unit IV **GIS** Introduction and applications of GIS in development sector. Loading QGIS and a district data-set. Using a given data-set. Writing queries and manipulating appearances. Types of objects and manipulating objects. Linking Census data to GIS. Basic analysis and representation. Introduction to a case-study. Basics of spatial planning queries such as computing net supply and net demand.	**08**
Unit V **Fieldwork, Village Report and Case-Study** Reading the CTARA Village Report. The sectors and its indices. The methodology. The reporting The basics of PRA-1. The Demand Side. Household-surveys. Focus group discussions. Drinking water and irrigation water. Community vs. Farmers. The issue ranking. Non water issues and issue ranking The basics of PRA-2. The supply side. Resource map. Assets, institutions and allocation documents. Time-line. Changes in crops and in welfare. The basics of PRA-3. The allocations. Questions of equity, efficiency and sustainability. Regional vs. Household balance. What should an engineer know about Caste, Class and Gender	**10**
Unit VI **Capstone Project via A Case Study** Framing the project. Understanding the demand. What needs to be achieved. Studying the options available. Measurement of social and economic parameters as inputs. The activities and the analysis. The reporting. Picking your case-study	**09**

Suggested list of Tutorials and Assignments:

Based on PRA activities carried out for projected village as case study.
General Instructions: Fieldwork attendance is mandatory.

Suggested Text Books:	
1.	http://www.cse.iitb.ac.in/~sohoni/TD463
2.	https://www.cse.iitb.ac.in/~sohoni/
3.	Participatory Rural Appraisal: Principles, Methods and Application by N. Narayanasamy
Suggested Reference Books:	
1.	Village level Census Data from census dept. Site.-Part I and II (i.e., amenities) and the metadata.
2.	MRSAC. Various maps and data-sets. Revenue map, GIS layers obtained from MRSAC. Village, taluka and district boundaries, watershed boundaries, roads, drainage, water bodies.
3.	Agriculture. Village and taluka agricultural data. Soil maps and other watershed maps.
4.	Irrigation. Salient features of tanks and projects. Irrigation rounds and canal network. Command area maps and cropping patterns.
5.	This course is based on the TD603 Water course taught at CTARA and also the TD609 and TD604 courses

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-II DESIGN OF CONCRETE BRIDGES**			**Course Code:**	**:**	CE 441
Teaching Scheme (Hours)	**:**	Lecture : 04 Hrs/week Tutorial : -- Hrs/week			**Total Credits**	**:**	04
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total = 100	**Duration of SEE**	**:**	3 hrs
Revision:	**:**	Second			**Month**	**:**	June 2023
Pre-requisites (if any)	**:**	CE 411					
Course Domain	**:**	Elective					

Course Rationale: *The course deals with the analysis and design of bride substructure and superstructure. The course aims how to select the appropriate system for bridge based on the understanding the pros and cons for each system. It will clarify the dead and live loads acting on any bridge and focus on the live loads calculations and the different cases of loading which is the most important part in the design.*

Course Objectives: The Course teacher will		**Course Outcomes:** Students will be able to	
1.	Discuss the IRC standard live loads and design the deck slab type bridges.	1.	Understand the IRC standard live loads and design the deck slab type bridges.
2.	Explain the method to analyze the box culverts for the given loading and detail the box culverts.	2.	Analyze the box culverts for the given loading and detail the box culverts.
3.	Illustrate the method to design and detail of T-Beam bridges	3.	Design and detail of T-Beam bridges.
4.	Explain the procedure to design and check the stability of piers and abutments.	4.	Design and check the stability of piers and abutments.
5.	Describe the bridge foundations and the reinforcement detailing and selection bearings.	5.	Understand the bridge foundations and prepare the reinforcement detailing and selection bearings.
6.	Describe the construction techniques adopted in bridge construction.	6.	Understand the Construction techniques adopted in bridge construction.

Curriculum Content	**Hours**
Unit I Standard specifications for Road Bridges. I.R.C. bridge code, width of carriage way, clearances, loads to be considered i.e. D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc. Aesthetics of bridges, general design considerations for R.C.C. and P.S.C. bridges, Traffic aspects for highway bridges.	9

Unit II Analysis and design of box culverts slab culverts – pipe culverts- Reinforcement detailing and bar bending schedule	12
Unit III Design of R.C. deck slab, beam and slab, T beam, Pigeaud's theory, Courbon's theory, balanced cantilever bridge,	10
Unit IV Analysis and Design of Abutments and pier- Reinforcement detailing	9
Unit V Bearing and expansion joints – forces on bearings – Types of bearings, design of unreinforced elastomeric bearings, expansion joints Repair, Strengthening, and Rehabilitation of Existing Bridges	6
Unit VI Construction techniques – construction of sub structure footing, piles, caissons, construction of reinforced earth retaining wall and reinforced earth abutments, super structure – erection method bridge deck construction, by cantilever method, Inspection maintenance and repair of bridges	6

Suggested list of Tutorials and Assignments:

At least one assignment on each unit.

Suggested Text Books:

1.	Krishnaraju N., "Advanced reinforced concrete design", CBS Publication and Distributors, 2000, 1st Edition.
2.	Johnsan V.D., "Essential of Bridge Engineering", Oxford and IBH Publishing Co., Pvt. Ltd.

Suggested Reference Books:

1.	Raina V.K., "Concrete Bridge Practice", Tata McGraw Hill.
2.	Punmia B.C., Jain A.K., Jain A.K., "Reinforced Concrete Structures – Vol II", Laxmi Publications, 1992, 7th Edition.
3.	Jagadesh T.R. and Jayram M.A., "Design of Bridge Structure", Prentice Hall of India Pvt. Ltd.
4.	Rowe R. E., "Concrete Bridge Design" John Wiley and Sons, 1963, 1st Edition.
5.	PonnuSwamy, "Bridge Engineering", 4th edition, Mc Graw-Hill Publication, 2008
6.	Vazirani, Ratvani & Aswani, "Design of Concrete Bridges", 5th edition, Khanna Publishers, 2006.
7.	Jagadish T.R. & M.A. Jayaram, "Design of Bridge Structures", 2nd edition, 2009.
8.	Swami Saran, "Analysis and Design of sub-structures", 2nd edition, Oxford IBH Publishing co ltd., 2006.

Reference Codes:

1.	IRC:6-2017, Standard Specifications and Code of Practice for Road Bridges, Section: II Loads and Load combinations (Seventh Revision)
2.	IRC: 18-2000, The Design Criteria for Prestressed Concrete Road Bridges

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-II STRUCTURAL DYNAMICS**			***Course Code*:**	**:**	CE 442
Teaching Scheme (Hours)	**:**	Lecture :	04 Hrs/week		***Total Credits***	**:**	04
		Tutorial :	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, CE 212, CE 221, CE 225, CE 321, CE 412					
Course Domain	**:**	Elective					

Course Rationale: *The course deals with vibration theory of the structures. The course aims to understand dynamic behavior of the structures subjected to lateral load. The objective of the course is to afford the basic concept understanding of the structural dynamics and the problem solving ability for dynamic response in civil engineering design, analysis and research. It will introduce students the analytical and numerical procedures in structural dynamics with emphasis on vibration and provide optimize system for desired dynamic response.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain basic concepts of Structural Dynamics	1.	Understand basic concepts of Structural Dynamics
2.	Illustrate procedure to evaluate displacements, amplitude of various SDOF systems	2.	Evaluate displacements, amplitude of various SDOF systems
3.	Describe SDOF systems subjected to general dynamic loading	3.	Derive equations of SDOF systems subjected to general dynamic loading
4.	Illustrate method to determine natural frequencies, mode shapes of MDOF system	4.	Determine natural frequencies, mode shapes of MDOF system
5.	Illustrate the procedure to determine Response of MDOF systems to dynamic loading	5.	Determine Response of MDOF systems to dynamic loading
6.	Explain Free and forced Vibration of continuous system	6.	Understand Free and forced Vibration of continuous system

Curriculum Content	**Hours**
Unit I Single – Degree of Freedom Systems, Analytical Models, Equation of Motion, Free Vibration, Damping, Types of damping, Types of damping, Response to harmonic loading, Resonance, Support motion, Transmissibility, Vibration isolation	12
Unit II SDOF system subjected to periodic and impulsive loading, Fourier series loading, Rectangular pulse, Introduction to Frequency –Domain Analysis	8
Unit III SDOF systems subjected to general dynamic loading, Duhamel's integral, Application to	8

simple loading cases, numerical evaluation of response integral, and Piece wise exact method	
Unit IV MDOF systems, selection of DOFs, formulation of equations of motion, Structure matrices, Static condensation, Free Vibration Eigen Value problem, Frequencies and Mode Shapes, Determination of natural frequencies and mode shapes by Stodola-Vianello method, Orthogonality conditions	9
Unit V Discrete systems, Fundamental mode analysis, Rayleigh method, Response of MDOF systems to dynamic loading, Mode superposition method, Coupled and Uncoupled equations of motion, Modal Contribution	8
Unit VI Distributed- parameter Systems, Partial differential equations of motion, Free and forced Vibration, Application to beams in flexure	7
Suggested list of Tutorials and Assignments: At least one assignment on each unit.	

Suggested Text Books:	
1.	Chopra A.K., "Dynamics of Structures", Dhanapat Rai and sons, New Delhi
2.	Mario Paz, "Structural Dynamics", CBS Publication
Suggested Reference Books:	
1.	Grover G.R., "Mechanical Vibrations", Roorkee University, Roorkee.
2.	Clough R. M. and Ponian, "Dynamics of Structures", McGraw Hill Co. New Delhi.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-II ADVANCED SURVEYING**			***Course Code*:**	**:**	--
Teaching Scheme (Hours)	**:**	Lecture :	-- Hrs/week		***Total Credits***	**:**	--
		Tutorial :	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11B2, CE 222, CEL 226					
Course Domain	**:**	Elective					

Course Rationale: *The course is very important, there would not have been railroads, skyscrapers could not have been erected and neither any individual could have put fences around their yards for not intruding others land. The advanced techniques of Surveying are included in the course.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain Application of the knowledge of geometric principles to arrive at surveying problems	1.	Apply the knowledge of geometric principles to arrive at surveying problems
2.	Explain procedure to Design the different types of curves for deviating type of alignments	2.	Design the different types of curves for deviating type of alignments
3.	Explain Implementation of the different types of curves for deviating type of alignments	3.	Implement the different types of curves for deviating type of alignments
4.	Explain procedure to capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;	4.	Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;
5.	Explain uses of modern instruments to obtain geo-spatial data	5.	Use modern instruments to obtain geo-spatial data
6.	Explain procedure to analyze the same to appropriate engineering problems.	6.	Analyze the same to appropriate engineering problems.

Curriculum Content	**Hours**
Unit I THEODOLITE Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite. Trigonometric Levelling: Trigonometric leveling (heights and distances-single plane and double plane methods). TACHEOMETRY Basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems. Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations.	8

Unit II ASTRONOMICAL SURVEYING Astronomical terms and definition – Motion of sun and stars – Celestial co-ordinate System - Time system - Nautical Alamance – Apparent attitude and corrections – Field observations and determinations of time, longitude, latitude and azimuth by attitude and Hour angle method. AERIAL SURVEYING Terrestrial Photogrammetry – Terrestrial stereo photogrammetry – Aerial photogrammetry – overlaps – scale of photographs – Vertical and titled photographs distortion in aerial photographs – stereostopic vision - photo interpretation – Applications.	9
Unit III CURVES – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (Numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two Parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics, numerical problems on Length of Transition curve, Vertical curves & Types – (theory).	9
Unit IV TOTAL STATION SURVEYING Classification – basic measuring and working principles of an Electro – optical and Microwave total station- sources of errors in Electro – optical and Microwave total station – Care and Maintenance of total station – trilateration – Applications.	8
Unit V Modern Surveying Instruments Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning). GPS SURVEYING Basic concepts – Space, Control and User segments – Satellite configuration – Signal structure – Orbit determination and representation – Antispoofing and selective availability – hand held and geodetic receivers – Field work procedure – Data processing Applications.	9
Unit VI Reconnaissance – Route surveys for highways, railways and waterways – simple, compound, reverse , transition and vertical curve – setting out methods - hydrographic surveying – tides – MSL – Sounding methods – measurement of current and discharge – Tunnel alignment and setting out – Settlement and Deformation studies	9
Suggested list of Tutorials and Assignments: **General Instructions:** At least one assignment on each unit.	
Suggested Text Books:	
1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications Pvt. Ltd., New Delhi.	

2.	Kanetkar T P and S V Kulkarni , Surveying and Leveling Part 2, Pune Vidyarthi Griha, Prakashan,
3.	K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi.
Suggested Reference Books:	
1.	Sateesh Gopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2.	S.K. Duggal, "Surveying Vol. I & II", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
3.	R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
4.	David Clerk, Plane and Geodetic Surveying Vol.1 and Vol.2, CBS publishers
5.	B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
6.	T.M Lilles and, R.W Kiefer, and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India
7.	James M. Anderson and Adward M. Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication.
8.	Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill Higher Education.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-III ENGINEERING OPTIMIZATION (OPEN ELECTIVE)**			***Course Code*:**	**:**	CE 448
Teaching Scheme (Hours)	**:**	Lecture :	04Hrs/week		***Total Credits***	**:**	04
		Tutorial :	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	The prerequisite for this course is to possess the fundamental knowledge of optimization aspects.					
Course Domain	**:**	Open Elective					

Course Rationale: *This course introduces students to 1) the process of formally representing an engineering design or decision-making problem as a mathematical problem and 2) the theory and numerical methods needed to understand and solve the mathematical problem. Theoretical topics focus on constrained nonlinear programming, including necessary and sufficient conditions for local and global optimality and numerical methods for solving nonlinear optimization problems.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To build knowledge among students about various optimization techniques in engineering.	1.	To apply optimization concepts to solve actual problems in engineering field.
2.	To understand usage of these techniques in specific regions.	2.	To formulate the field problem and then select appropriate technique to optimize the same within the constraints.
3.	To understand the importance of optimization techniques in construction sector	3.	To familiarize with optimizing the given engineering problem by adopting a suitable technique effectively

Curriculum Content	**Hours**
Unit I Engineering applications, various techniques, single and Multivariate optimization; Linear Programming - Standard form, simplex method, Decomposition principle, applications to structural design problems	**8**
Unit II Nonlinear Programming - Unimodal function, Elimination and Interpolation methods; Unconstrained Optimization Techniques - Direct search methods, Descent methods, Conjugate gradient method.	**8**

Unit III Constrained Optimization Techniques - Characteristics of the Problem. Direct methods and indirect methods, Convex programming problem.	**9**
Unit IV Optimization in Structural design -Minimum weight and optimum cost considerations, application to Trusses and Frames, design of reinforced beams and slabs.	**9**
Unit V Classical optimization techniques-differential calculus-Lagrange multipliers, Newton Raphson approximation, Kutin tucker conditions, examples	**9**
Unit VI Geometric Programming- Calculus viewpoint, polynomials, orthogonality conditions, degree of difficulty, geometric inequality, primal-dual relations, inequality constraints, example	**9**

Suggested list of Tutorials and Assignments:

At least one assignment on each unit

Suggested Text Books:

1.	W. S. Hemp, "Optimum Structures", Oxford Engineering Science Series
2.	Leonard Spunt , "Optimum Structural Design", Prentice Hall, New Jersey
3.	S. S. Rao, "Optimisation", Wiley Eastern Ltd

Suggested Reference Books:

1.	Narsingh Rao, "Graph Theory", Prentice Hall
2.	Gallagher and O C Zienkiewics, "Optimization", John Wiley and Sons, London
3.	Taha, H. A., "Operation Research", Mac-Millan
4.	Wagner, "Operation Research", Wiley Eastern Ltd.
5.	Lick D., "Project Management", Gower Publication England

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-III ENGINEERING ECONOMICS AND VALUATION (OPEN ELECTIVE)**			***Course Code*:**	**:**	CE449
Teaching Scheme (Hours)	**:**	Lecture :	04 Hrs/week		***Total Credits***	**:**	04
		Tutorial :	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 213, CE 217, CE224, CE229, CE 315					
Course Domain	**:**	**Open Elective**					

Course Rationale: *Engineering economics is important for the proper and efficient use of limited and scarce resources. It involves the application of technical and economic analysis with the goal of deciding best meets technical performance criteria and uses scarce capital in a prudent manner. The study of engineering economics draws upon knowledge of engineering and economics to address problems of allocating limited resources. Also "Valuation" provides technique of estimating and determining the fair price or value of a property such as a building, a factory or other engineering structures of various types, land etc. Civil Engineering students have to acquire basic knowledge of engineering economics and valuation.*

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To know various basics concepts of Engineering Economy.	1.	Understand and describes basic elements of Engineering Economy.
2.	To carry out "economic appraisal of projects".	2.	Do economic appraisal based on various methods.
3.	To learn basic elements of valuation, methods and basic terms related to immovable properties.	3.	To understand and describe basic elements of valuation, methods of valuation, terms related to immovable properties.
4.	To learn computational parameters and method of valuation for open land	4.	To describe computational parameters for valuation and to apply method of valuation for open land.
5.	To understand, "Rental Method of Valuation" and "Direct comparison of Capital Value Method".	5.	To apply "Rental Method of Valuation" and "Direct comparison of Capital Value Method" for valuation of land with building.
6.	To understand valuation Based on Profits, development and Cost Method	6.	To apply method of valuation based on Profits, cost and development.

Curriculum Content	**Hours**
Unit I **Introduction to Engineering Economy** Time value of money, Asset, Liability, Interest rate, Inflation rate, Discrete and continuous compounding, Cash flow diagrams, Project Cash flow and Company cash flow diagrams, Factors affecting project cash flow,, Using cash flow diagram determining capital lock up,	8

Determining cash requirement of Project, Balance sheet, Tangible-intangible costs and benefits, Concept of economic viability, Cost-benefit analysis, Payback period, Return on capital.	
Unit II **Economic Appraisal of Projects** Interest formulae for discrete and continuous compounding, Nominal and Effective interest. Effect of inflation on interest rate, Present worth method, Concept of Equivalence comparison, Future worth method, Annual worth method, Selection of appropriate method for equivalence comparison, Discounting cash flow, Internal rate of return, Methods for determining IRR, IRR for economic viability. Comparison of project alternatives based on IRR.	9
Unit III **Elements of Valuations** Purposes of valuation, factors affecting valuations, Concept of value, price and cost, attributes of value, various types of values and essential characteristics of market value, Various methods of valuation. **Immovable Properties** Freehold and leasehold properties, Different types of leases. Different types of rents, Depreciation, different methods, sinking fund, obsolescence, land as a real estate.	8
Unit IV **Computational parameters for valuation** Years Purchase, Single rate and dual rate, reversion value of land, net yield, capitalized value, Valuation tables. Depreciated value of buildings, **Method of Valuation for open land** Comparative method, Abstractive method, Belting method, Methods of valuation for lands with buildings.	9
Unit V **Rental Method of Valuation and Direct comparison of Capital Value** Gross rent, outgoings, net rent, capitalized value and Deferred value of land, Value of extra open area in the plot, total value of the property, Rating valuation, Rate as the property tax, Fundamental principles of rating valuation, basis for rating valuation, various allowances while determining assessed value. Method of Direct comparison of Capital Value	9
Unit VI **Valuation Based on Profits, Development and Cost Method** Premises to be valued by Valuation Based on Profits, Gross profit, outgoings, net profit, and capitalized value, Deferred value of land, Value of extra open area in the plot, and total value of the property. Types of developments, Plotting scheme, hypothetical building scheme, Cost of development, Stamp duty, Engineering and supervision charges, Incidental charges, and Developer's profit, Purposes of valuation for development, computation of buying or selling prices.	9
Suggested list of Tutorials and Assignments: At least one assignment on each unit	
Suggested Text Books:	

1.	"Engineering Economy" Brajesh Kumar, Arshad Noor Siddiquee, Zahid A. Khan Publisher: Pearson India, 1st Edition, 2012.
2.	"Civil Engineering Contracts &Estimates", B. S. Patil, Orient Langman Ltd., 1st Edition, 1981.
3.	"Professional Practices (Estimating & Valuation)", Roshan Namavati., LBD Publishers, 4th Edition, 1984.
4.	Engineering Economy and Management, Pravin Kumar, Wiley Publication
Suggested Reference Books:	
1.	"Engineering Economy", Leland Blank and Anthony Tarquin, 8th edition, McGraw Hill
2.	"Engineering Economy" William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Pearson Publication
3.	"Valuation of Real Properties" Rangwala, Charotar Publishing House, 10th Edition: 2015
4	"Engineering Economy", Zahid A khan, New Delhi: Dorling Kindersley, 1st Edition, 2012

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-III FINITE ELEMENT METHOD (OPEN ELECTIVE)**			***Course Code*:**	**:**	CE 450
Teaching Scheme (Hours)	**:**	Lecture :	04 Hrs/week		***Total Credits***	**:**	04
		Tutorial :	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Course Domain	**:**	Open Elective					

Course Rationale: *Finite element method is used to solve the complex engineering problems. The applications of finite elements are not limited to only the field of Civil Engineering, but also extended in the field of Mechanical Engineering, Aeronautics and Medical.Hence, the course is included as open elective.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain fundamentals of finite element method (FEM) of analysis.	1.	Understand the fundamentals of finite element method
2.	Describe the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.	2.	Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
3.	Illustrate theanalysis of linear 1D problems like bars and trusses, 2D structural problems using CST element and analysis of the axi-symmetric problems with triangular and rectangular elements.	3.	Analyze linear 1D problems like bars and trusses; 2D structural problems using CST element and analyse the axi-symmetric problems with triangular and rectangular elements.
4.	Describe application of direct stiffness, Rayleigh-Ritz, Galerkin method to solve engineering problems and outline the requirements for convergence.	4.	Apply direct stiffness, Rayleigh-Ritz, Galerkin method to solve engineering problems and outline the requirements for convergence.
5.	Illustrate theanalysis of three-dimensional elements	5.	Analyze three-dimensional elements
6.	Explain applications of FEM in Solid Mechanics	6.	Know applications of FEM in Solid Mechanics

Curriculum Content	**Hours**
Unit I **Basic Concepts** Introduction to finite element method, History, applications. Stress strain relationship, strain displacement relationship. Equilibrium equations (Minimum potential energy approach, virtual work approach), Basic bar element	8
Unit II **One-dimensional Finite Elements** Bar Element, Beam Element, Consistent nodal loads, Element displacement fields, Shape functions and interpolation polynomials	9

Unit III **Two-dimensional Elements** Equations from theory of Elasticity, Potential energy for the continuum, General finite-element formulation, Triangular elements, CST, LST elements, Rectangular elements.	9
Unit IV **Methods** Method of Weighted Residuals, The Galerkin Finite Element, Element Formulation, Application of Galerkin's Method to Structural Elements, Bar Element, Beam Element, Rayleigh- Ritz method.	8
Unit V **Three-dimensional Analysis** Tetrahedral elements, Constant strain tetrahedron Triangular Elements, Rectangular hexahedral Elements, Axisymmetric Elements, Isoperimetric Formulation, Numerical Integration: Gaussian Quadrature	9
Unit VI **Applications in Solid Mechanics** Plane-stress, Plane-Strain Formulation, Isoperimetric formulation for Plane Quadrilateral Element, Axisymmetric stress Analysis, Strain and Stress Computation	9

Suggested list of Tutorials and Assignments:
At least one assignment on each unit.

Suggested Text Books:

1.	Cook R.D., "Concepts and Applications of Finite Element Analysis", John Wiley, New York 1995
2.	Reddy J.N., "An Introduction to finite element method", Tata McGraw Hill publication, 3rd edition, 2006.
3.	Desai C.S., "An Introduction to finite element method", CBS publication and Distributors, 4th edition, 2011.

Suggested Reference Books:

1.	Dawe D. J., "Matrix and Finite Element Displacement Analysis of Structures", Oxford Uni Press, 1984
2.	David Hutton, "Fundamentals of Finite Element Analysis", McGraw-Hill,2004
3.	Belegundu A.D. And Chandrupatla T.R., "Finite Element Methods in Engineering", Prentice hall India 1991
4.	Reddy J.N, "Finite Element Methods", John Wiley and sons 1982
5.	Buchanan G.R., "Finite Element Analysis", McGraw Hill Publications New York 1995
6.	Chandrupatla T.R. and Belegunda A.D.," Introduction to Finite Elements in Engineering", Prentice Hall India.
7.	Seshu P., Textbook of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010.
8.	Bathe K.J., ―Finite Element Procedures, Prentice-Hall of India (P) Ltd., New Delhi.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-III NUMERICAL METHODS (OPEN ELECTIVE)**			***Course Code*:**	**:**	CE 451
Teaching Scheme (Hours)	**:**	Lecture:	04 Hrs./week		***Total Credits***	**:**	04
		Tutorial:	00 Hrs./week				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs.
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, ES-11A7, BS-12A1.					
Course Domain	**:**	Open Elective					

Course Rationale: *The course mainly deals with Numerical methods. The prerequisite for this course is to possess the knowledge of C' programming language.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To provide the numerical methods of solving the non-linear equations.	1.	Explain the consequences of finite precision and the inherent limits of the numerical methods considered.
2.	To provide the numerical methods of solving the interpolation, differentiation, and integration.	2.	Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.
3.	To improve the student's skills in numerical methods by using the numerical analysis software and computer facilities.	3.	Demonstrate they understand the mathematics concepts underlying the numerical methods considered.
4.	To Apply the numerical methods to solve Civil Engineering problems.	4.	Demonstrate understanding and implementation of numerical solution algorithms applied to the following classes of problems: a. Finding roots of equations b. Solving systems of algebraic equations c. Curve fitting d. Interpolation

Curriculum Content	**Hours**
Unit I The meaning of Numerical Methods, Significance of Numerical Methods, Accuracy and Precision, Error, Round-off Error, Truncation Error, Total Error, Relative Error, Percentage Error, Significance of Error Computation in Numerical Methods, Pre-specified Error, Error Propagation, and Importance of Modern Computers in Numerical Methods	09
Unit II Roots of Nonlinear Equations, Simple One-Point Iteration, Newton-Raphson Method, Secant Method, Multiple Roots, System of Nonlinear, Equations.	08

Unit III Systems of Linear Algebraic Equations, Review of Graphical Method, Cramer's Rule. Naïve gauss elimination Method, pitfalls of elimination method. Techniques for improving solution, Gauss Jordan method, Gauss Seidel Method.	09
Unit IV Curve fitting, Difference between regression and interpolation. Interpolation: Linear interpolation, quadratic interpolation, General form of Newton's Interpolating Polynomial, Newton's divided difference interpolation polynomials, Lagrange's Interpolating Polynomials.	08
Unit V Necessity of statistical approach, review of basic concepts of statistics, Linear Regression: Least Squares Method, Polynomial Regression, Nonlinear Regression.	09
Unit VI Numerical Differentiation and integration, Trapezoidal Rule, Simpson's Rule, Solutions of Ordinary Differential Equations, Runge-Kutta Method, Classification of Partial Differential Equations, Solution by Liebmann's Method. Introduction to Finite Element Method.	09

Suggested list of Tutorials and Assignments:

Assignment No. 1: Accuracy and Precision, Error, Round-off Error, Truncation Error, Total Error, Relative Error, Percentage Error, Significance of Error Computation in Numerical Methods
Assignment No. 2: Roots of Nonlinear Equations
Assignment No. 3: Systems of Linear Algebraic Equations
Assignment No. 4: Interpolation
Assignment No. 5: statistical approach.
Assignment No. 6: Numerical Differentiation and integration

General Instructions: Along with curriculum to expose students to various aspects in relation to course contents. Preparation of assessment as per unit wise.

Suggested Text Books:

1.	Rao S. S., "Numerical Methods', Tata McGraw Hill Publications, 2002, 3rd Edition.
2.	E. Balguruswamy, "Numerical Methods"

Suggested Reference Books:

1.	Chapra S.C. and Canale R.P., "Numerical Methods for Engineers", Tata McGraw Hill Publications, 2002, 4th Edition.
2.	Goldberg D.E., "Genetic Algorithm", Pearson Education, 2000, 1st Edition.
3.	Gerald. C.F. And Wheatly. P.O., "Applied Numerical Analysis", Addison Wesley, 1994, 5th Edition
4.	Sastry S. S., "Introductory Methods of Numerical Analysis", 5th edition, Prentice Hall of India Delhi.
5.	Khoury, Richard, Harder, Douglas Wilhelm, "Numerical Methods and Modelling for Engineering", Springer International Publishing, 2016.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**ELECTIVE-III REMOTE SENSING AND GIS APPLICATION (OPEN ELECTIVE)**			***Course Code*:**	**:**	CE 452
Teaching Scheme (Hours)	**:**	Lecture : 04 Hrs/week Tutorial : -- Hrs/week			***Total Credits***	**:**	04
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Second			***Month***	**:**	June 2023
Course Domain	**:**	Open Elective					

Course Rationale: *Remote Sensing is a technology to gather information and analyzing an object or phenomenon without making any physical contact. This technology is used in numerous fields like geography, hydrology, ecology, oceanography, glaciology, geology. The aim of this course to acquaint the students with various applications of remote sensing in Civil Engineering.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To get a basic and advanced level insight into the approach of latest remote sensing techniques	1.	get a basic and advanced level insight into the approach of latest remote sensing techniques
2.	To understand the subject of Geographical information system as an extension of application software in civil engineering	2.	understand the subject of Geographical information system as an extension of application software in civil engineering
3.	To understand various applications of remote sensing in Civil Engineering	3.	understand various applications of remote sensing in Civil Engineering

Curriculum Content	**Hours**
Unit I **Introduction and Basic Concepts** Introduction, basic concepts of remote sensing, airborne and space born sensors, passive and active remote sensing emr spectrum, energy sources and radiation principles energy interactions in the atmosphere energy interactions with earth surface features, spectral reflectance curves	8
Unit II **Remote Sensing Systems** Satellites and orbits, polar orbiting satellites spectral, radiometric and spatial resolutions, temporal resolution of satellites multispectral, thermal and hyperspectral sensing. Indian remote sensing satellites and their features	8
Unit III **Digital Image Processing - Image Restoration and Image Enhancement** Geometric corrections co-registration of data, ground control points (GCP) atmospheric corrections, solar illumination corrections concept of color, color composites contrast stretching – linear and non-linear stretching filtering techniques, edge enhancement density slicing, thresholding, Intensity Hue saturation (IHS) images, time composite images, synergetic images	9

Unit IV **Digital Image Processing - Information Extraction and Digital Image Processing Software** Introduction to Multispectral classification, Ground truth correction, Supervised and unsupervised classification Change detection analysis, Principal component analysis Ratio images, Vegetation indices Image processing software, Multispectral classification algorithms Image processing using software	9
Unit V **Digital Elevation Modeling** Introduction, Sources of digital elevation data, Types of DEM Radar interferometry, Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data, DEM for Slope, Aspect, Flow direction, Flow pathways, Flow accumulation, Streams, Catchment area delineation, Counter and draining extraction. Developing stereopairs and anaglyphs	9
Unit VI **Remote Sensing Applications** Remote Sensing Applications in: Watershed management, Rainfall-runoff modeling, Irrigation management, Flood mapping, Drought assessment, Environmental monitoring Geomorphology, land use and land cover, soil mapping, site selection, route alignment, cartography, highway engineering, reservoir siltation **GIS** Definition, functions of GIS, Types of data – spatial, non-spatial, point, line polygon, vector and raster database, Spatial databases, Coordinate systems and geo-referencing, Interpolation methods – Deterministic and Statistical, Strategies for development, implementation and management of GIS	9

Suggested list of Tutorials and Assignments:
At least one assignment on each unit

Suggested Text Books:

1.	T.M. Lillesand and R.W. Kiefer, 'Remote Sensing and Image Interpretation', John Wiley and Sons, New York. 6th edition, 2008
2.	J.B. Campbell, 'Introduction to Remote Sensing', Taylor and Francis, London, 1996
3.	T. J. M. Kennie and M. C. Mathews, 'Remote sensing in Civil Engineering', Surry University press, London, 1985

Suggested Reference Books:

1.	F.F. Sabins, 'Remote Sensing: Principles and Interpretation', W.H. Freeman and Company, New York, 1997
2.	Paul Longley, M.F. Goodchild, 'Geographical Information System, Volume I and II', John Wiley and Sons, Inc. 1999.
3.	Agarwal C.S. and Garg P.K., "Textbook on Remote Sensing in Natural Resources Monitoring and Management", Wheeler Publishing, Allahabad.
4.	Keith P.B. and Thompson et al., "Remote sensing and water resources management", American Water Resources Association, Urbana Illinois
5.	Lillesand T.M. and Kiefer R.W., "Remote sensing and Image interpretation", John Wiley and Sons, New York.
6.	Meijerink M.J., HAM de Brouwer, Mannaerts C.M. and Velenzuela C.R., "Introduction to the use of Geographical Information Systems for Practical hydrology", ITC Publication No. 23, UNESCO, Paris

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**MAJOR PROJECT PHASE-II**			***Course Code*:**	**:**	CEL 424
Teaching Scheme (Hours)	**:**	Practical :	2 Hrs/week		***Total Credits***	**:**	4
Evaluation Scheme (Marks)	**:**	IOE = 50	EOE= 100	Total= 150	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	The prerequisite for this course is to possess the fundamental knowledge of Civil Engineering					
Course Domain	**:**	core					

Course Rationale: *The projects help students in different ways like the formation of groups, understanding group behavior, improving communication skills, learning in-depth within minimum time, interaction with the guide and outside agencies and arriving at the best technical solution.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To carry out extensive literature survey on the research topic	**1.**	perform extensive literature survey and identify research topic of work
2.	To identify the problem statement for the research work.	**2.**	identify the problem statement for the research work
3.	To decide methodology for the research work.	**3.**	Decide methodology for the research work.
4.	To carry out initial mathematical modeling or experimental set up.	**4.**	carry out mathematical modeling or experimental program for the proposed work

List of Experiments

Sr. No.	
1.	**Project Topics**: Project topics should preferably be design, development, design aid type and interdisciplinary. The projects should aim at training the students in going through all important phases of project studies starting from establishing the need through collection of data, analysis, design, development, drawing, cost estimates and project reports, where appropriate some alternatives which meet the same needs should also be considered and evaluated using appropriate evaluation criteria.
2.	**Methodology for Project Evaluation:** Project group consists of a minimum THREE and maximum FIVE students. The group is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. During the First Stage of the Project Students would identify a project in area related with engineering and carryout the necessary literature review. Based on the literature review during first stage of the project student would write a report which would give a review of literature, problem formulation and methodology to be adopted. The report would be presented through a seminar which would be evaluated at the end of the term by the panel of internal and external examiners. The Work may consist of the following points: **1.** Problem Formulation **2.** Survey of Literature **3.** Experimental investigation/ Data collection **4.** Design and Fabrication of Model **5.** Industrial Assignment
3.	The assessment of the project will be done at the end of the semester by a committee consisting of three faculty members from the department along with Project Guide. The students will present their project work before the committee. A minimum ten-page typed report excluding photographs based

	on the work done will have to be submitted in prescribed format to the assessing committee. The committee will award the marks to the individual students. One Project Guide shall be allotted maximum TWO groups for guidance. For work load calculation minimum load is 2hr/week, for one group of FOUR to FIVE students. (As per AICTE Guide Lines).

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VII**					
Course Title	**:**	**LAB-I RCC DESIGN AND DRAWING - I**			***Course Code*:**	**:**	CEL 416
Teaching Scheme (Hours)	**:**	Practical :	2 Hrs/week		***Total Credits***	**:**	1
Evaluation Scheme (Marks)	**:**	IOE: 50	EOE = --	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, ES-11A5, CE 211, CEL 216, CE 221, CEL 229, CE 311 , CE 312, CEL 328					
Course Domain	**:**	core					

Course Rationale: *The objective in RCC structure design is to produce a structure capable of resisting all applied loads without failure during its intended life. The objective can be fulfilled by: (i) Understanding the strength and deformation characteristics of concrete and steel, (ii) Following the clearly defined standards for materials, production, workmanship and maintenance, and use of structures in service, (iii) Adopting measures needed for durability.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To prepare detailing of reinforcement of members under various loading conditions	**1.**	Implement the concepts of structural design procedure
2.	To prepare schedule of the reinforcement	**2.**	Design the individual members and hence building as a whole.
3.	To understand behavior of RCC elements under flexure, shear and axial stresses	**3.**	To practice the elementary design of different structural elements

List of Experiments

Sr. No.	List of experiments: (Any 8)
4.	**Design Assignments Shall Consist of Following:** 8. Design of RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group). 9. The drawings would be drafted using Drafting Package/ Auto CAD. Four full size drawing sheets would be drawn using drafting software/ Auto CAD. 10. Bar bending schedule and detailing of reinforcements as per standard professional practice and relevant IS codes. 11. Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects. 12. Design of multistoried RC buildings using software such as STAAD.Pro, STRUD, ETABS, etc. 13. For the architectural layouts necessary for the RCC design assignments, buildings designed for the Laboratory work on Building Design and Drawing and Building Planning would be taken as basis. 14. Report of a site visit related to building structure under construction.
5.	**Design Assignments Shall Consist of Following:** 8. Design of RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group).

	9. The drawings would be drafted using Drafting Package/ Auto CAD. Four full size drawing sheets would be drawn using drafting software/ Auto CAD. 10. Bar bending schedule and detailing of reinforcements as per standard professional practice and relevant IS codes. 11. Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects. 12. Design of multistoried RC buildings using software's such as STAAD.Pro, STRUD, ETABS, etc. 13. For the architectural layouts necessary for the RCC design assignments, buildings designed for the Laboratory work on Building Design and Drawing and Building Planning would be taken as basis. 14. Report of a site visit related to building structure under construction.
6.	**Design Assignments Shall Consist of Following:** 8. Design of RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group). 9. The drawings would be drafted using Drafting Package/ Auto CAD. Four full size drawing sheets would be drawn using drafting software/ Auto CAD. 10. Bar bending schedule and detailing of reinforcements as per standard professional practice and relevant IS codes. 11. Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects. 12. Design of multistoried RC buildings using software's such as STAAD.Pro, STRUD, ETABS, etc. 13. For the architectural layouts necessary for the RCC design assignments, buildings designed for the Laboratory work on Building Design and Drawing and Building Planning would be taken as basis. 14. Report of a site visit related to building structure under construction
Suggested Text Books/ Reference Books/Manual	
1.	N.C. Sinha and S.K. Roy, "Fundamentals of Reinforced Concrete", S. Chand publications, 4th edition, 2013.
2.	B. C. Punmia, A.K. Jain and A.K. Jain, "Comprehensive Design of R.C. Structures", Laxmi Publications,10th edition, 2015.
3.	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures publications, 8th edition, 2014.
4.	A. K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand and brothers- Roorkee, 7th edition, 2012.
Suggested Reference Books:	
1.	P.C. Varghese, "Limit State Design of reinforced concrete", Prentice-hall of India Pvt.Ltd , 2ndEdition, 2004
2.	M. L. Gambhir and McMillan, "Reinforced Concrete Design", PHI learning Pvt. Ltd, 4thEdition, 2006

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB II ELECTIVE-II ADVANCED DESIGN OF STRUCTURE**			***Course Code*:**	**:**	CEL 443
Teaching Scheme (Hours)	**:**	Practical	2 hr/weeks		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE = --	EOE=50	Total = 50	***Duration of SEE***	**:**	
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 221 , CE 223, CE 311, CE 312,					
Course Domain	**:**	Elective					

Course Rationale: *The objective in advance design of structure is to expose the students to advanced level of structural analysis and design using special methods of analysis and using relevant software's.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To understand behavior of special RC structures under various loadings	**1.**	**Apply** advanced methods for analysis of structures.
2.	To analyze and design special RC structures	**2.**	**Calculate** forces and displacements in special structures.
3.	To draft detailing of reinforcement in special RC structures as per IS provisions	**3.**	**Prepare** structural detailing drawings of special structures.

Curriculum Content	**Hours**
The laboratory work should include the **assignments** based on following: 1. Unit 1- Flat slab 2. Unit 2- Pile foundation 3. Unit 3- Design of chimney 4. Water tank design 5. Retaining wall design 6. Yield line theory	

Suggested Text Books/ Reference Books/Manual

1.	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures publications, 8th edition, 2014.
2.	N Krishna Raju, "Advanced Reinforced Concrete Design", CBS publishers and distributors, 2nd edition, 2010.
3.	Ramamrutham, "Design of Reinforced Concrete Structures", Dhanpatrai and son's Publication, 9th edition, 1981.

Suggested Reference Books:

1.	P Purushothaman, "Reinforced Concrete Structural Elements", McGraw- Hill publication, 3rd. edition, 2004

2.	G.S. Ramaswamy, " Design and Construction of Concrete Shell Roofs", McGraw- Hill publication, New York, 1968
3	A.K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand and bros. publications, 7th edition, 2012
4	Jain and Jai Krishna, "Plain and Reinforced Concrete–Vol. I and II", Nem Chand Bros. Publication, Roorkee.
5	Taylor C. Pere, "Reinforced Concrete Chimneys",Laxmipublications,7thedition, New Delhi
6	Jones LL and Thomas and Hudson, "Yield Line Analysis of Slabs", Chatto and windus Publisher, London, 1967
7	Design of deep girders, Concrete Association of India
8	Mallick and Gupta, "Reinforced Concrete", Oxford and IBH publishing co. Pvt. Ltd.6thedition,1996
Suggested Reference Codes:	
1	Codes of Practice IS 456-2000, plain and reinforced concrete
2	IS 3370: code of practice concrete structures for the storage of liquids
3	IS13920-2016
4	SP34-1987

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB II ELECTIVE-II ADVANCED GEOTECHNICAL ENGINEERING**			***Course Code*:**	**:**	CEL 444
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE=-	EPE/EOE= 50	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 313, CE 325					
Course Domain	**:**	Elective					

Course Rationale: *The course is important to acquaint knowledge to determine Safe Bearing Capacity of soil, which is further basis to design the foundation of the structures.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To study foundation and bearing capacity aspects	**1.**	Students will be able to plan and execute soil exploration activity
2.	To study ground improvement techniques	**2.**	Student will be able to decide soil parameters for foundation design
3.	To study foundations on expansive soils	**3.**	Student will be able to design foundation for expansive soil.
4.	To study methods of ground improvement	**4.**	Student will be able to determine bearing capacity of rock

List of Experiments

The laboratory work should include the following:

Sr. No.	**Assignments on the following topics**
1.	Computation of Bearing Capacity and settlement for eccentric footing
2.	Computation of Bearing Capacity of pile
3.	Laterally loaded pile and pile group
4.	Uplift capacity of pile and pile group
5.	Design of sheet pile
6.	Design of under reamed pile
7.	Design of PVD

Suggested Text Books

1.	Dr. B. J. Kasmalkar, “Foundation Engineering”, Pune Vidyarthi Griha Prakashan, Pune.
2.	Gopal Ranjan and A.S. Rao, “Basic and Applied Soil Mechanics”, New Age International Publishers, (2010).
3.	B.C. Punmia, “Soil Mechanics and Foundation Engineering”, Laxmi Publication.
4.	A.K. Arora, “Soil Mechanics and Foundation Engineering”, Standard Publishers, 2009.
5.	P.C. Varghese,” Foundation Engineering”, PHI learning private limited, 2014.

Suggested Reference Books:	
1.	J. E. Bowles, "Foundation Analysis and Design", McGraw-Hill International.
2.	B. M. Dass, "Foundation Engineering", Cengage Learning; 7 edition.
3.	N.V. Nayak, "Foundation Design Manual", Dhanpat Rai and Sons, First Edition.
4.	IS Codes such as, IS:1904 (1986), IS: 6403 (1981), IS: 8009Part I (1986), IS: 12070 (1987).

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB II: ELECTIVE-II DEVELOPMENT ENGINEERING**			***Course Code*:**	**:**	CEL 445
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE=00	EOE=50	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Course Domain	**:**	Elective					

Course Rationale: *The course is based on the extensive experience of CTARA over the last 30 years of forming abridge between engineers and society, of development of case-studies as a way of documenting and transmitting practices.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To understand delivering value by solving societal problems	**1.**	Understand about Society and its Organization .
2.	To understand the Sectoral Engineering System as specific case study.	**2.**	Understand the detail report based on fieldwork.
3.	To knowledge application to Linking Census data to GIS.	**3.**	Identify finally what has been achieved.

List of Experiments

Sr. No.	
1.	**A) Assignment based on course topics.**
2.	**B) Field Visit** **Visit 1:** To an irrigation system or another specific sector from Civil engg. Program. Meeting with an NGO, farmers, a state officer and an elected representative. **Visit 2:** Preparing for the village meeting. Census data. Key contacts. What to look for. 2 days and 2 nights at the village. Village meeting, household meeting, Resources.
3.	**C) Village Report and Case-Study**

General Instructions: Fieldwork attendance is mandatory.

Suggested Text Books/ Reference Books/Manual

1.	http://www.cse.iitb.ac.in/~sohoni/TD463

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB-II ELECTIVE-II DESIGN OF CONCRETE BRIDGES**			***Course Code*:**	**:**	CEL 446
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= --	EOE=50	Total=50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 411					
Course Domain	**:**	Elective					

Course Rationale: *The course deals with the analysis and design of bride substructure and superstructure. The course aims how to select the appropriate system for bridge based on the understanding the pros and cons for each system. It will clarify the dead and live loads acting on any bridge and focus on the live loads calculations and the different cases of loading which are the most important part in the design.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain the method to analyze the box culverts for the given loading and detail the box culverts.	**1.**	Analyze structures subjected to any kind of dynamic excitation and computing quantities like displacements, forces, stresses, etc.
2.	Illustrate the method to design and detail of T-Beam bridges	**2.**	Understand the analytical methods and procedures in a way that emphasize physical insight.
3.	Explain the procedure to design and check the stability of piers and abutments.	**3.**	Apply the structural dynamics theory to real-world problems like seismic analysis and design of structures.
4.	Describe the bridge foundations and the reinforcement detailing and selection bearings.	**4.**	Understand the bridge foundations and prepare the reinforcement detailing and selection bearings.

List of Experiments

Sr. No.	The laboratory work should include the following:
7.	Assignment based on following topics i. Classification of Bridges ii. Components of Bridges iii. Design loads and its combination iv. Design of R. C. deck slab, beam and slab, T beam v. Box culvert vi. Design of bridge components - Abutments, Wing walls, Piers, Approach slab vii. Bearing and expansion joints viii. Construction Techniques
8.	Design of any one type of bridge (analytically)
9.	Design of any one type of bridge by using software
10.	Visit to bridge construction site

Suggested Text Books/ Reference Books/Manual

1. Krishnaraju N., "Advanced reinforced concrete design", CBS Publication and Distributors, 2000,

	1st Edition.
2.	Johnsan V.D., "Essential of Bridge Engineering", Oxford and IBH Publishing Co., Pvt. Ltd.
3.	Punmia B.C., Jain A.K., Jain A.K., "Reinforced Concrete Structures – Vol II", Laxmi Publications, 1992, 7th Edition.
4.	Swami Saran, "Analysis and Design of sub-structures", 2nd edition, Oxford IBH Publishing co ltd., 2006.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB-II ELECTIVE-II STRUCTURAL DYNAMICS**			***Course Code*:**	**:**	CEL 447
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE=--	EOE= 50	Total=	***Duration of EPE***	**:**	---
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, ES-11A5, CE 225, CEL 227, CEL 447					
Course Domain	**:**	Elective					

Course Rationale: *The laboratory aims to understand of Vibration of SDOF system subjected to lateral load and effect of planar asymmetry in SDOF system. It will provide demonstration of mode shapes for MDOF system subjected to lateral load. It also help to understand mode shapes of continuous systems.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Demonstrate the concept of vibration response to SDOF system subjected lateral load.	**1.**	Understand the concept of vibration response to SDOF system subjected lateral load.
2.	Demonstrate the concept of vibration response to asymmetric plan SDOF system subjected lateral load.	**2.**	Understand the concept of vibration response to asymmetric plan SDOF system subjected lateral load.
3.	Demonstrate the concept of vibration response to MDOF.	**3.**	Understand the concept of vibration response to MDOF
4.	Demonstrate the mode shapes of continuous system.	**4.**	Understand the mode shapes of continuous system.

List of Experiments

Sr. No.	The laboratory work should include the following: (Any 8)
1.	Dynamics of a three storied building frame subjected to harmonic base motion
2.	Dynamics of a one-storied building frame with symmetry subjected to harmonic base motion
3.	Dynamics of a one-storied building frame with infill stiffness subjected to harmonic base motion
4.	Dynamics of a one-storied building frame with planer asymmetry subjected to harmonic base motion
5.	Dynamics of a three storied building frame with infill subjected to harmonic base motion
6.	Dynamics of a three storied building frame with and without infill at ground floor subjected to harmonic base motion
7.	Dynamics of one span beam
8.	Dynamics of two span beam
9.	Dynamics of structures subjected to liquefaction
10.	Earthquake induced waves in rectangular tanks

General Instructions: Any 8 experiments should be submitted as laboratory work

Suggested Text Books/ Reference Books/Manual

1.	Hosur V.I., "Earthquake Resistant Design of RCC structures", Willey Publication
2.	Paz Mario, "Structural Dynamics", CBS Publishers and Distributers, 2004
3.	Earthquake Engineering Lab Manual, IISC, Bangalore

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB III ELECTIVE-III ENGINEERING OPTIMIZATION (OPEN ELECTIVE)**			***Course Code*:**	**:**	CEL 453
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE= 50	EPE/EOE=--	Total=50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Course Domain	**:**	Open Elective					

Course Rationale: *This course introduces students to 1) the process of formally representing an engineering design or decision-making problem as a mathematical problem and 2) the theory and numerical methods needed to understand and solve the mathematical problem. Theoretical topics focus on constrained nonlinear programming, including necessary and sufficient conditions for local and global optimality and numerical methods for solving nonlinear optimization problems.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To build knowledge among students about various optimization techniques in engineering	1.	To apply optimization concepts to solve actual problems in engineering field.
2.	To understand usage of these techniques in specific regions	2.	To formulate the field problem and then select appropriate technique to optimize the same within the constraints
3.	To understand the importance of optimization techniques in construction sector.	3.	To familiarize with optimizing the given engineering problem by adopting a suitable technique effectively.

List of Experiments

Sr. No.	**The laboratory work should include the following:**
1.	At least One Assignment on each topic.
2.	Real life problem optimization solving using few techniques.

Suggested Text Books:

1.	W. S. Hemp, “Optimum Structures”, Oxford Engineering Science Series
2.	Leonard Spunt , “Optimum Structural Design”, Prentice Hall, New Jersey
3.	S. S. Rao, “Optimisation”, Wiley Eastern Ltd

Suggested Reference Books:

1.	Narsingh Rao, “Graph Theory”, Prentice Hall
2.	Gallagher and O C Zienkiewics, “Optimisation”, John Wiley and Sons, London
3.	Taha, H. A., “Operation Research”, Mac-Millan
4.	Wagner, “Operation Research”, Wiley Eastern Ltd.
5.	Lick D., “Project Management”, Gower Publication England

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB III ELECTIVE-III ENGINEERING ECONOMICS AND VALUATION**			***Course Code*:**	**:**	**CEL 454**
Teaching Scheme (Hours)	**:**	Practical :	**2 Hrs/week**		***Total Credits***	**:**	1
Evaluation Scheme (Marks)	**:**	IOE=50	EOE=--	Total=50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	CE 315					
Course Domain	**:**	**Open Elective**					

Course Rationale

Engineering economics is important for the proper and efficient use of limited and scarce resources. It involves the application of technical and economic analysis with the goal of deciding best meets technical performance criteria and uses scarce capital in a prudent manner. The study of engineering economics draws upon knowledge of engineering and economics to address problems of allocating limited resources. Also "Valuation" provides technique of estimating and determining the fair price or value of a property such as a building, a factory or other engineering structures of various types, land etc. A Civil Engineering student has to acquire basic knowledge of engineering economics and valuation.

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To provide a sound understanding of concepts and principles of engineering economy.	**1**	To understand and describe basic elements of engineering economics.
2.	To learn various methods of valuation.	**2**	To apply various methods for valuation of real properties.
3.	To understand use of software for economic comparison and valuation	**3.**	To use software for economic comparison and valuation.

List of Experiments

1. At least one assignments based on each topic.
2. Introduction to various software's used for economic comparisons and valuation.
3. Use of various functions related to engineering economics from software's.
4. Property Valuation using any one software.
5. Valuation Report of Residential Building,

Suggested Text Books/ Reference Books/Manual

1. "Professional Practices (Estimating & Valuation)", Roshan Namavati., LBD Publishers, 4th Edition, 1984.
2. "Engineering Economy", Leland Blank and Anthony Tarquin, 8th edition, McGraw Hill
3. "Engineering Economy" William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Pearson Publication
4. "Valuation of Real Properties" Rangwala, Charotar Publishing House, 10th Edition: 2015

Class, Part& Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB III ELECTIVE-II FINITE ELEMENT METHOD**			***Course Code*:**	**:**	CEL 455
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= 50	EOE=--	Total= 50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Course Domain	**:**	Open Elective					

Course Rationale: *Finite element method is used to solve the complex engineering problems. The applications of finite elements are not limited to only the field of Civil Engineering, but also extended in the field of Mechanical Engineering, Electronics, Aeronautics and Medical.Hence, the course is included as open elective.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Describe the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.	**1.**	Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
2.	Illustrate the analysis of linear 1D problems like bars and trusses, 2D structural problems using CST element and analysis of the axi-symmetric problems with triangular and rectangular elements.	**2.**	Analyze linear 1D problems like bars and trusses; 2D structural problems using CST element and analyse the axi-symmetric problems with triangular and rectangular elements.
3.	Illustrate the analysis of three-dimensional elements	**3.**	Apply direct stiffness, Rayleigh-Ritz, Galerkin method to solve engineering problems and outline the requirements for convergence.
4.	To understand the use FEM software in real life structure.	**4.**	Enhance the knowledge in numerical analysis with FE software's and FE programs

List of Experiments

Sr. No.	The work shall consist of following:
1.	Two Assignment on Basic Concepts
2.	Two Assignments on FE Analysis of Plane Truss and Plane Frame
3.	Three Assignments on Analysis of beams, rigid jointed space frame, Galerkin method
4.	Use of ANSYS, ABAQUS and MATLAB to carryout FE analysis of plane structures

General Instructions: Report of laboratory work must be submitted depending upon assignments and software demonstration

Suggested Text Books/ Reference Books/Manual

1.	Desai C.S., "An Introduction to finite element method", CBS publication and Distributors, 4th edition, 2011.
2.	Cook R.D., "Concepts and Applications of Finite Element Analysis", John Wiley, New York 1995
3.	Reddy J.N., "An Introduction to finite element method", Tata McGraw Hill publication, 3rd edition, 2006.
4.	Zindani D. , Roy A.K. , Kaushik Kumar, "Working with ANSYS: A Tutorial Approach", International Kindle
5.	Edward Magrab , Shapour Azarm, Balakumar Balachandran, Keith Herold, Gregory Walsh, "Engineers Guide to MATLAB, 3rd Edition", International Kindle

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB III ELECTIVE-II NUMERICAL METHODS**			***Course Code*:**	**:**	CEL 456
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs./week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= 50	EOE=--	Total=50	***Duration of EPE***	**:**	----
Revision:	:	Second			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ES-11A2, ES-11A7, BS-12A1.					
Course Domain	**:**	Open Elective					

Course Rationale : *The course mainly deals with Numerical methods. The prerequisite for this course is to possess the knowledge of C' programming language.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To Develop numerical methods to approximate a function using C' programming language on Nonlinear Equations and Linear Regression	**1.**	Use the bisection method, false position, Newton's, Secant method to estimate the number of iterations in the algorithm to achieve desired accuracy with the given tolerance
2.	To Code various numerical methods in a modern computer language	**2.**	Use polynomial interpolations including the Lagrange polynomial, Newton's cotes, for curve fitting method to evaluate the interpolations

List of Experiments

Sr. No.	Experiments shall consist of at least 12 programs with flowcharts, source listing, input and outputs based on above topic in 'C' programming language on
1.	**Roots of Nonlinear Equations** i) Newton-Raphson Method.
2.	ii) Secant Method.
3.	**Cramer's Rule** i) Pitfalls of elimination method.
4.	ii) Gauss Jordan method.
5.	iii) Gauss Seidel method.
6.	**Curve Interpolation** i) Linear interpolation ii) quadratic interpolation.
7.	ii) quadratic interpolation.
8.	iii) General form of Newton's Interpolating Polynomial
9.	iv) Newton's divided difference interpolation polynomials
10.	v) Lagrange's Interpolating Polynomials
11.	**Linear Regression**: i) Least Squares Method ii) Polynomial Regression iii) Nonlinear Regression
12.	**Trapezoidal Rule & Simpson's Rule**

General Instructions Along with curriculum to expose students to various aspects in relation to course contents. Preparation of assessment as per unit wise.

Suggested Text Books/ Reference Books/Manual

1.	Chapra S.C. AndCanale R.P., "Numerical Methods for Engineers", Tata McGraw Hill Publications, 2002, 4th Edition.

2.	Goldberg D.E., "Genetic Algorithm", Pearson Education, 2000, 1st Edition.
3.	Gerald. C.F. And Wheatly. P.O., "Applied Numerical Analysis", Addison Wesley, 1994, 5th Edition
4.	Sastry S. S., "Introductory Methods of Numerical Analysis", 5th edition, Prentice Hall of India Delhi.

Class, Part & Semester	**:**	**Final Year B. Tech. (Civil Engineering), Part IV, Semester VIII**					
Course Title	**:**	**LAB III ELECTIVE-III REMOTE SENSING AND GIS APPLICATION**			***Course Code*:**	**:**	CEL 457
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE= 50	EPE/EOE=--	Total=50	***Duration of EPE***	**:**	----
Revision:	**:**	Second			***Month***	**:**	June 2023
Course Domain	**:**	Open Elective					

Course Rationale: *Remote Sensing is a technology to gather information and analyzing an object or phenomenon without making any physical contact. This technology is used in numerous fields like geography, hydrology, ecology, oceanography, glaciology, geology. The aim of this course to acquaint the students with various applications of remote sensing in Civil Engineering.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To get a basic and advanced level insight into the approach of latest remote sensing techniques	1.	Get a basic and advanced level insight into the approach of latest remote sensing techniques
2.	To understand the subject of Geographical information system as an extension of application software in civil engineering	2.	Understand the subject of Geographical information system as an extension of application software in civil engineering
3.	To understand various applications of remote sensing in Civil Engineering	3.	Understand various applications of remote sensing in Civil Engineering

List of Experiments

Sr. No.	**The laboratory work should include the following:** Following work has to be performed in the practical hours:
1.	Complete details to be procured on satellites and their orbits through study
2.	Assignments on “Image enhancement techniques”
3.	Application of remote sensing and GIS to civil engineering – report and presentation
4.	Any one assignment using MATLAB or any remote sensing software
5.	Application study will be submitted in report and a presentation will be done on it.
6.	CD of the report and presentation will be submitted by the student to the concerned faculty and will be graded accordingly

Suggested Text Books

1.	T.M. Lillesand and R.W. Kiefer, ‘Remote Sensing and Image Interpretation’, John Wiley and Sons, New York. 6th edition, 2008
2.	J.B. Campbell, ‘Introduction to Remote Sensing’, Taylor and Francis, London, 1996
3.	T. J. M. Kennie and M. C. Mathews, ‘Remote sensing in Civil Engineering’, Surry University press, London, 1985

Suggested Reference Books:

1.	F.F. Sabins, ‘Remote Sensing: Principles and Interpretation’, W.H. Freeman and Company, New York, 1997
2.	Paul Longley, M.F. Goodchild, ‘Geographical Information System, Volume I and II’, John Wiley and Sons, Inc. 1999.
3.	Agarwal C.S. and Garg P.K., “Textbook on Remote Sensing in Natural Resources Monitoring

	and Management", Wheeler Publishing, Allahabad.
4.	Keith P.B. and Thompson et al., "Remote sensing and water resources management", American Water Resources Association, Urbana Illinois
5.	Lillesand T.M. and Kiefer R.W., "Remote sensing and Image interpretation", John Wiley and Sons, New York.
6.	Meijerink M.J., HAM de Brouwer, Mannaerts C.M. and Velenzuela C.R., "Introduction to the use of Geographical Information Systems for Practical hydrology", ITC Publication No. 23, UNESCO, Paris

Class &Semester	:	**Final Year B.Tech. (Civil Engineering), Part IV, Semester VIII**								
Course Title	:	**PROFESSIONAL ETHICS**						***Course Code*:**	:	**AC 427**
Teaching Scheme (Hours)	:	**Lecture= 2 hr /Week**						***Credits***	:	**02**
Evaluation Scheme (Marks)	:	**Assignments** **Viva voce**	: :	**50** **25**	**Written Test** **Grand Total**	: :	**25** **100**	***Duration of Exam***	:	**Not Applicable**
Revision	:	**Second**						***Month***	:	**June 2023**
Pre-requisites	**:**	It does not require any pre-requisite as such but eager to know about our profession's connectivity, role and responsibility towards society and environment.								
Course Domain	**:**	Audit Course at institute level , Humanities & Social Science								

Course Rationale: The *course includes ethics and responsibility of engineers as professionals.*

Course Objectives: The Course Teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain importance of engineers' connectivity with society and environment.	**1.**	Realize the role of engineers towards society and environment.
2.	Make students aware ofethics and responsibility of engineers as professionals.	**2.**	Demonstrate ethical practices and responsibility as a professional.
3.	Make them able toundergo ethical judgments and solve problems.	**3.**	Make ethical judgments and solve problems.
4.	Develop attitudes required of engineers and values shared by engineers	**4.**	Get developed forengineers' attitude with sharing of values.
5.	Help them practice decision making & team players.	**5.**	Practice decision making and team culture.
6.	Describe importance of lifelong learning.	**6**	Follow lifelong learning attitude.

Curriculum Content	**Hours**
Unit I: Engineer, Society and Environment 1. Understanding of the relation between engineering and society/Environment. 1.1 Understanding of the effects and impacts of science and technology on human society. 1.2 Understanding the effects and impacts of science and technology on the natural environment.	**07**
1.3 Understanding the characteristics of the modern globalized world.	**07**
Unit II: Ethics and engineering Profession 2 Understanding of ethics and responsibilities of engineers as Professionals. 2.2 Understanding of the roles and responsibilities of engineers in Society. 2.3 Understanding of the basic concepts and theories of ethics. 2.4 Understanding the relation between law and ethics and having basic legal literacy. 2.5 Understanding of the nature of professional ethics.2.6 Understanding of the purposes and roles of codes of ethics and those of conduct set by engineering societies and associations. 2.7 Understanding of the social responsibility (SR) of organizations (companies in particular). 2.8 Understanding of ethics in specific areas (and knowledge of concrete cases) 2.9 Understanding the nature of ethics in research and development	**06**

Unit III: Ethical Perception and Problem solving 3 Ability to make ethical judgments and solve problems. 3.2 Understanding and application of methods to identify related factors in ethical issues and to make a structural analysis of them. 3.3 Understanding and application of methods to analyze technical factors in ethical issues and make structural analysis of them. 3.4 Understanding and application of methods to analyze organizational factors and provide organizational solutions. 3.5 Ability to design one's conduct to solve ethical problems Based on the abilities to analyze factors gained through 3.2–3.4, 3.6 Comprehensive problem-solving capability **Unit IV: Engineer's attitude and Social Responsibility** 4 Attitude required of engineers and values shared by engineers. 4.1 Attitude to think autonomously and independently based on an understanding of the responsibility of an engineer. 4.2 Attitude to accept a diversity of values (recognizing the existence of the various value systems different from their own as well as the multiplicity of values). 4.3 Attitude to share values (such as safety emphasized in the codes of ethics) to which engineers should assign paramount importance. 4.4 Attitude and willpower to act on ethical judgments of their own.	**06**

Reference Books:

1. Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. Seth, M. L., "Principles of Economics", Lakshmi Narain Agarwal, Agra.
3. Agarwal, A.N., "Indian Economy", Vikas Publishing House Pvt. Ltd., New Delhi.
4. Datta R. and Sundharam, "Indian Economy", K. P. M., S. Chand & Co. Ltd., New Delhi
5. Prof. M P Raghavan, "Professional Ethics in Engineering", SCITECH Publication (India) Pvt. Ltd., Second Edition

Equivalence of subjects

Final Year B. Tech. (Civil Engineering) Semester VII and VIII

The above detailed syllabus is a revised version of the Final Year. B. Tech (Civil Engineering) course being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from Academic year 2022-2023). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.
The Equivalence for the subjects of Civil Engineering at Final Year B Tech Semester VII and VIII pre-revised course under the faculty of Engineering and Technology is as follows.

Final Year B. Tech. (Civil Engineering) Semester VII

Name Course (Old Syllabus)	Equivalent Course (New Syllabus)	Remarks
CE 411: Design of RCC Structures -I	CE 411: Design of Concrete Structures -I	Title and Syllabus revised
CE 412: Structural Dynamics and Earthquake Engineering	CE 412: Structural Dynamics and Earthquake Engineering	Syllabus revised
CE 413: Estimating and Costing	CE 413: Estimating and Costing	Syllabus revised
CE 414: Water Resources Engineering - II	CE 414: Water Resources Engineering - II	Syllabus revised
Elective-I		
CE 428: Advanced analysis of structure	CE 428: Advanced analysis of structure	Syllabus revised
CE 429: Energy Efficient and Cost-Efficient Building Technology	CE 429: Green Building Design	Title and Syllabus revised
CE 430: Human Resource Management in construction	CE 430: Human Resource Management in construction	Syllabus revised
CE 431: Transportation in Infrastructure planning and Demand Estimation	CE 431: Transportation in Infrastructure planning and Demand Estimation	Syllabus revised
CE 432: Watershed Management	CE 432: Watershed Management	Syllabus revised
CEL 415: Major Project Phase-I	CEL 415: Major Project Phase-I	Evaluation method changed.
CEL 416: Lab-I Structural Design and Drawing - II	CEL 416: Lab-I RCC Design and Drawing - I	Syllabus revised
CEL 417: Lab-II Structural Dynamics and Earthquake Engineering	CEL 417: Lab-II Structural Dynamics and Earthquake Engineering	Syllabus revised
CEL 418: Lab-III Estimating and Costing	CEL 418: Lab-III Estimating and Costing	Syllabus revised
Lab IV Elective-I		
CEL433: Advanced analysis of structure	CEL 433: Advanced analysis of structure	Syllabus revised
CEL434: Energy Efficient and Cost-Efficient Building Technology	CEL 434: Green Building Design	Syllabus revised
CEL435: Human Resource Management in construction	CEL 435: Human Resource Management in construction	Syllabus revised
CEL436: Watershed Management	CEL 436: Watershed Management	Syllabus revised
CEL437: Transportation in Infrastructure planning and Demand Estimation	CEL437: Transportation in Infrastructure planning and Demand Estimation	Syllabus revised
AC 416: Introduction to Constitution of India	AC 416: Introduction to Constitution of India	Syllabus revised

Final Year B. Tech. (Civil Engineering) Semester VIII

Name Course (Old Syllabus)	Equivalent Course (New Syllabus)	Remarks
CE 421: Design of RCC Structures-II	CE 421: Design of Concrete Structures - II	Title and Syllabus revised
CE 422: Construction Practices	CE 422: Construction Practices	Syllabus revised
CE423: Town and Country Planning	CE423: Town and Country Planning	Syllabus revised
Elective-II		
CE 438: Advanced Design of Structures	CE 438: Advanced Design of Structures	Syllabus revised
CE 439: Advanced Geotechnical Engineering	CE 439: Advanced Geotechnical Engineering	Syllabus revised
CE 440: Development Engineering	CE 440: Development Engineering	Syllabus revised
CE 441: Design of Concrete Bridges	CE 441: Design of Concrete Bridges	Syllabus revised
CE 442: Structural Dynamics	CE 442: Structural Dynamics	Syllabus revised
----	CE 443: Advanced Surveying	Newly introduced
Elective-III		
CE 448: Engineering Optimization	CE 450: Engineering Optimization	Syllabus revised
CE 449: Engineering Economics and Valuation	CE 451: Engineering Economics and Valuation	Syllabus revised
CE 450: Finite Element Method	CE 452: Finite Element Method	Syllabus revised
CE 451: Numerical Methods	CE 453: Numerical Methods	Syllabus revised
CE 452: Remote Sensing and GIS application	CE 454: Remote Sensing and GIS application	Syllabus revised
CEL 424: Major Project Phase - II	CEL 424: Major Project Phase - II	Evaluation method changed.
CEL425 Lab-I Structural Design and Drawing - III	CEL 425: Lab-I RCC Design and Drawing - II	Syllabus revised
Lab-II Elective-II		
CEL 443: Advanced Design of Structures	CEL 444: Advanced Design of Structures	Syllabus revised
CEL 444: Advanced Geotechnical Engineering	CEL 445: Advanced Geotechnical Engineering	Syllabus revised
CEL 445: Development Engineering	CEL 446: Development Engineering	Syllabus revised
CEL 446: Design of Concrete Bridges	CEL 447: Design of Concrete Bridges	Syllabus revised
CEL 447: Structural Dynamics	CEL 448: Structural Dynamics	Syllabus revised
---	CEL 449: Advanced Surveying	Newly introduced
Lab-III Elective-III		
CEL 453: Engineering Optimization	CEL 455: Engineering Optimization	Syllabus revised
CEL 454: Engineering Economics and Valuation	CEL 456: Engineering Economics and Valuation	Syllabus revised
CEL 455: Finite Element Method	CEL 457: Finite Element Method	Syllabus revised
CEL 456 Numerical Methods	CEL 458: Numerical Methods	Syllabus revised
CEL 457: Remote Sensing and GIS application	CEL 459: Remote Sensing and GIS application	Syllabus revised
AC 427: Professional Ethics	AC 427: Professional Ethics	Syllabus revised