Shivaji University, Kolhapur
Department of Technology
FINAL YEAR B.TECH
Civil Engineering
Curriculum Structure

Semester – VII

Sr. No.	Subject Code	Subject Title	Contact hours			Credits
			L	T	P	
1	CE 411	Design of RCC Structures -I	3	1	-	4
2	CE 412	Estimating and Costing	3	-	-	3
3	CE 413	Earthquake Engineering	3	-	-	3
4	CE 414	Water Resource Engineering-II	3	-	-	3
5		Elective-I	3	-	-	3
	CE 415	Major Project Phase-I	-	-	2*	3
6	CE 416	Laboratory- I Structural Design And Drawing-II	-	-	2	1
7	CE 417	Laboratory-II Estimating and Costing	-	-	2	1
8	CE 418	Laboratory-III Earthquake Engineering	-	-	2	1
9		Laboratory-IV Elective-I	-	-	2	1
10	CE 419	Report on Field/Industrial Training	-	-	-	1
11	AC 416	Audit Course VI Professional Ethics	2	-	-	-
		Total	17	1	10	24
Total Contact hours per week = 28						

Semester –VIII

Sr. No.	Subject Code	Subject Title	Contact hours			Credits
			L	T	P	
1	CE 421	Design of RCC Structures -II	3	1	-	4
2	CE 422	Town and Country Planning	3	-	-	3
3	CE 423	Construction Practices	3	-	-	3
4		Elective-II	3	-	-	3
5		Elective-III OPEN Elective (Interdisciplinary)	3	-	-	3
	CE 424	Major Project (Phase-II)	-	-	2*	4
6	CE 425	Laboratory- I Structural Design And Drawing-II	-	-	4	2
7		Laboratory-II Elective-II	-	-	2	1
8		Laboratory-III Elective-III	-	-	2	1
10	AC 427	Audit Course VII Constitution of India	2	-	-	-
		Total	17	1	10	24
Total Contact hours per week = 28						

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

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

List of Proposed Electives for B. Tech

ELECTIVE-I, ELECTIVE-II AND ELECTIVE-III Subjects

CE 430 Advanced Environmental Engineering

CE 431 Systems Approach in Civil Engineering

CE 432 Matrix Analysis of Structures

CE 433 Remote Sensing and GIS Applications

CE 434 Human Resource Management in Construction

CE 435 Advanced Analysis of Structures

CE 436 Advanced Design of Structures

CE 437 Plumbing Services

CE 438 Advanced Engineering Geology

CE 439 Advanced Geotechnical Engineering

CE 44020 Water Resources Planning and Management

CE 441 Finite Element Method

CE 442 Advanced Foundation Engineering

CE 443 Fiber Reinforced cement Composites

CE 444 Energy Efficient and Cost- Effective Building Technologies

CE 445 Advanced Water and Waste Water Treatment

CE 446 Advanced Concrete Technology

CE 447 Engineering Optimization

CE 448 Structural Dynamics

CE 449Reinforced Soil and Applications

CE 45020Numerical Methods

CE 451 Computer Applications in Civil Engineering

CE 452 Design of Concrete Bridges

CE 453 Experimental Stress Analysis

CE 454 Transportation Infrastructure Planning and Demand Estimation

CE 455 Pavement Analysis, Design and Evaluation

CE 456 Hydrology and Watershed Management

CE 457 Water Power Engineering

CE 458 Open Channel Hydraulics

CE 459 Analysis and Design of Earthquake Resistant Structures

CE OPEN ELECTIVE (Interdisciplinary)

ELECTIVE-I, ELECTIVE-II and ELECTIVE-III Laboratory

CEL 460 Advanced Environmental Engineering Laboratory

CEL 461 Systems Approach in Civil Engineering Laboratory

CEL 462 Matrix Analysis of Structures Laboratory

CEL 463 Remote Sensing and GIS Applications Laboratory

CEL 464 Human Resource Management in Construction Laboratory

CEL 465 Advanced Analysis of Structures Laboratory

CEL 466 Advanced Design of Structures Laboratory

CEL 467 Plumbing Services Laboratory

CEL 468 Advanced Engineering Geology Laboratory

CEL 469 Advanced Geotechnical Engineering Laboratory

CEL 470 Water Resources Planning and Management Laboratory

CEL 471 Introductions to Finite Element Analysis Laboratory

CEL 472 Advanced Foundation Engineering Laboratory

CEL 473 Fiber Reinforced cement Composites Laboratory

CEL 474 Energy Efficient And Cost- Effective Building Technologies Laboratory

CEL 475 Advanced Water and Waste Water Treatment Laboratory

CEL 476 Advanced Concrete Technology Laboratory

CEL 477 Engineering Optimization Laboratory

CEL 478 Structural Dynamics Laboratory

CEL 479 Reinforced Soil and Applications Laboratory

CEL 480 Numerical Methods Laboratory

CEL 481 Computer Applications in Civil Engineering Laboratory

CEL 482 Design of Concrete Bridges Laboratory

CE 483 Experimental Stress Analysis Laboratory

CEL484 Transportation Infrastructure Planning and Demand Estimation Laboratory

CEL485 Pavement Analysis, Design and Evaluation Laboratory

CEL486 Hydrology and Watershed Management Laboratory

CEL487 Water Power Engineering Laboratory

CEL488 Open Channel Hydraulics Laboratory

CEL489 Analysis and Design of Earthquake Resistant Structures Laboratory

CE OPEN ELECTIVE (Interdisciplinary)

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII)

CE 411 DESIGN OF RCC STRUCTURES

Teaching Scheme: L: 3 hrs/week **Credits: 4**

T: 1 hr/week

UNIT 1 **6 hrs**

Design philosophies of R.C structures (WSM, LSM), Structural elements, loads on structures, and structural properties of concrete, Role of structural engineer.

R.C. sections in flexure: theory and design, singly, doubly reinforced rectangular and flanged sections**.**

UNIT 2 **7 hrs**

One-way slab - simply supported, cantilever and continuous. Design of staircase: Dog legged and open well.

UNIT 3 **6 hrs**

Two way slab- simply supported, continuous and restrained

UNIT 4 **7 hrs**

Design of beams for flexure, shear, bond and torsion: Simply supported, continuous, cantilever

UNIT 5 **6 hrs**

Re-distribution of moments in beams. Column, axially loaded, short and long, uni-axial and biaxial moments.

UNIT 6 **7 hrs**

Isolated column footing, axial load, uni-axial and biaxial moments. Eccentric footing, Footing in difficult soil conditions.

Reference Books

1. Dayaratnram P., “Limit State Analysis and Design”,Wheeler Publishing company, Delhi.
2. Dr. Shah V. L. and Dr. Karve S.R., “Limit State Theory and Design”, Pune Vidyarthi Publication.
3. Jain A. K., “Reinforced Concrete Design (Limit State)”-
4. Punmia, Jain and Jain, “Comprehensive Design of R.C. Structures”, Standard Book House , New Delhi.
5. Sinha, “RCC Analysis and Design”, Vol. II and I, S. Chand and Co., New Delhi.
6. Sinha and Roy, “Fundamentals of Reinforced Concrete”.
7. Varghese P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi
8. IS: 456-2000, Handbook of Reinforced Concrete SP: 16, SP: 34.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VII)

CE 412 ESTIMATING AND COSTING

Teaching Scheme: L: 3 hrs/week **Credits: 3**

UNIT 1 **7 hrs**

Estimating

Definition, importance of quantity surveying for civil engineer, purpose, types of estimates, data required for estimates. Item of work, Description of an item work, units of measurement and principles deciding the Funits, I.S. and PWD mode of measurements of building. Definition and purpose of approximate estimate, methods of approximate estimating of building and other civil engineering projects like roads, irrigation and water supply and sanitary engineering

UNIT 2 **6 hrs**

Taking out Quantities

Principles, methods of taking out quantities for different assignments mentioned in laboratory work, Abstracting bill of quantities, provisional and prime cost items, contingencies, establishment charges, Centage charges.

UNIT 3 **7 hrs**

Analysis of Rates

Factors affecting cost an item of work materials, labour, tools, and plant, overheads and profit. Task work-definition and factors affecting task work, Transportation of material and cost Schedule of materials and labour, schedule of rates(D.S.R).Analysis of rates of different items mentioned in T.W.

UNIT 4 **6 hrs**

Specifications

Definition and purpose, types, drafting specifications, legal aspect, specifications of stone masonry, wood work, earth work, reinforcing brick work of R.C.C. work.

UNIT 5 **7 hrs**

Valuation of Property

Purpose, nature of value, price, constant value, factors affecting value of a property.

Free hold and leasehold property. Depreciation and methods of working out depreciation, sinking fund, years purchase, out goings

Methods of valuation

i) Land and building basis

ii) Rental basis

iii) Reproduction and replacement cost basis

iv) Profit basis, fixation of rent.

UNIT 6 **6 hrs**

Contracts and Tenders

General idea, Types of contracts. Law of contract, definition, objects and essentials of contract conditions specific condition, condition regarding EM, SD, Time limits (its importance). Liquidated damages and other more important condition regarding addition, alteration , extra items, testing and materials, defective work, subletting powers delegated to engineer in charge, regarding the above aspect, defect liability period, retention money, termination of contract, condition regarding payment to contractors , interim payment or running amount bills, advance payment, secure advance ,final bill

Tenders and tender Notice

Tender, Types of tenders, invitation of tender notice, documents, methods of preparation and submission of tenders, scrutiny of tenders, acceptance of tenders, general idea of global tenders.

Methods of Extending Work

PWD procedure of execution of work, Administrative approval, budget provision technical sanction, Different methods of execution of work in PWD, like piecework, rate list, day work, daily labour

Reference Books

1. Bhasin P.L., “Quantity Surveying”,
2. Chakraborti M. , “Estimating ,Costing and Specification in Civil Engineering”,
3. Dutta B.N., “Estimating and costing” ,
4. Rangwala, “Elements Of Estimating and Costing” ,
5. Patil B.S., “Civil Engineering Contracts and Estimates”, III edition, Univeristies Press
6. PWD Hand Book and Red Book
7. PWD District Schedule of Rates (DSR) – Latest

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VII)

CE 413 EARTHQUAKE ENGINEERING

Teaching Scheme: L: 3 hrs/week **Credits: 3**

UNIT 1 **7 hrs**

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, cause of earthquake damage, history of past earthquake.

UNIT 2 **6 hrs**

Vibration Theory

Free and forced vibration of single degree, two degree, damping, response spectra.

UNIT 3 **7 hrs**

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.

UNIT 4 **6 hrs**

Concept of Seismic Design

Evaluation of seismic force as per Indian code, modal analysis techniques, lateral load analysis of building, Torsion

UNIT 5 **7 hrs**

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.

UNIT 6 **6 hrs**

New Techniques in Aseismic Design

Base Isolation technique, Seismic dampers

References Books :

1. Arya A.S., "Earthquake Resistant, Design of Masonry and Timber Structures",
2. Chopra Anil.K., "Dynamics of Structures", Prentice Hall of India Pvt. Ltd.2006
3. Clough R. W. and Penzien Joseph, "Dynamics of Structures", McGraw Hill Co.
4. Dowrick D. J., "Earthquake Resistant Designs", John Wiley and Sons
5. Gosh S. K., "Earthquake Resistant Design of R. C. C. Structures"
6. Grover G. R., "Mechanical Vibrations", Roorkee University, Roorkee.
7. Krishna Jai, "Elements of Earthquake Engineering", South Asian Pub. New Delhi
8. Pankaj Agarwal and Shrikhande Manish, "Earthquake Resistant Design of Structures", Prentice Hall of India, New Delhi, 2006
9. Paz Mario, "Structural Dynamics", CBS Publishers and Distributers, 2004
10. Rochter, "Elements Seismology",
11. Earthquake Resistant Design Philosophy, MCE and DBE planning aspects, symmetry, simplicity, regularity
12. Government of Maharashtra Earthquake resistant Design of house guiding lines and assessment of damages
13. Manual of Earthquake Resistant Non engineering Construction, University, Roorkee

IS CODE REFERENCES

- IS:1893(2002), Indian Standard Criteria For Earthquake Resistance of Structures (Part I): General Provisions and Building (Fifth Revision), Bureau of Indian Standards, New Delhi
- IS:4326 Criteria for Earthquake Resistant Design and Construction of Buildings – Code of Practice, Bureau of Indian Standards, New Delhi
- IS:13827
- IS:13828
- IS:13920(1993), Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force – Code of Practice, Bureau of Indian Standards, New Delhi
- IS 456 (2000), Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VII)

CE 414 WATER RESOURCES ENGINEERING-II

Teaching Scheme: L: 3 hrs/week **Credits: 3**

UNIT 1

Introduction **6 hrs**

Types of Dam, Choice of dam, height, various components of dam

Gravity Dam

Forces acting and design of Gravity Dams, low and high dams, construction of Gravity Dam.

UNIT 2 **7hrs**

Earth Dam

Elements of Earth Dam, basic design consideration, design of section, design of filters, rock toe, pitching, causes of failures, piping and its prevention, rolled filled construction.

UNIT 3 **6 hrs**

Spillway and Gates

Spillway capacity, flood absorption and disposal, different types of Spillway, their principles of design and construction, energy dissipation below Spillway. Types and uses.

UNIT 4 **7 hrs**

Diversion Head Works

Selection of sites, layout of the work types of weirs and barrages, design of subsurface flow, safety against piping and uplift, Bligh, Lane, and Khosala's Theories, design of weirs on permeable foundations.

Canal Irrigation

Types of canal, canal alignment, losses in irrigation channels. Design of lined channels, various types of canal lining, economics of lining.

UNIT 5 **6 hrs**

Preliminary Sediment Transport Theory

Critical Tractive Force, regimes of flow, resistance of bed forms, suspended and bed load, its effect on channel design. Design of stable channels in alluvium, the regime method, Semi theoretical approached, cross-section of irrigation channels.

Canal Masonry Works

Cross drainage works, necessity types and selection, comparative merits and demerits, principles of design of various types of cross drainage work, falls, types and design, regulation, distributory head regulating works.

UNIT 6 **7 hrs**

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.

Hydro Power

General features of Hydro-power, types of development, general layouts of different types, Assessment of power potential, main components of Hydro-power schemes.

Types and selection of turbines, setting of turbines, cavitation

Reference Books

1. Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers Delhi, 2007.
2. Goldin A. L. and Rasskazor, L. N., "Design of Earth Dams,
3. Modi P.N.,Irrigation, "Water Resource and Water Power Engineering", Standard Book House, Delhi, 2008.
4. River Behaviour, Management and Training, CBIP Vol-I, 1989
5. Subramanya K., "Engineering Hydrology", Tata McGraw Hill., 2008
6. Varshney R. S., "Concrete Dams", Oxford and IBH Publishing Co.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VI)

Laboratory-III

CE 415 MAJOR PROJECT (Phase-I)

Teaching Scheme: P: 2hrs/week **Credit: 3**

Project Topics

Project Topics should preferably be design, development, design aid type and interdisciplinary. The project 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.

Methodology for Project Evaluation

During the First Stage of the Project Students would identify a project in a 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

Note:

Seminar Report for Phase-I would cover Literature Review, Project Formulation and Time Scaled Schedule for Phase-II of the Project Work. Seminar would be evaluated by the panel of examiners. Preferably same panel of examiners will be maintained during second stage evaluation. Project group will consist of not more than six with minimum three students in a group.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VII)

Laboratory-I

CEL 416 STRUCTURAL DESIGN AND DRAWING -II

Teaching Scheme: P: 2 hrs/week **Credit: 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 softwares 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.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VI)

Laboratory-II

CEL 417 ESTIMATING AND COSTING

Teaching Scheme: P: 2hrs/week **Credit: 1**

A) Working out Detailed Quantities for

i) A Two storied R.C.C. framed building based on prevailing DSR rates for Kolhapur District

ii) Estimation of quantities of steel reinforcement for an R.C.C. frame structure in (i) above

iii) Detailed Estimate of Residential Drainage and Water Supply Project

B) Preparation of Estimate using Computer Software

Detailed estimate of any two of the following

a. One column, column footing, beam and slab panel.

b. Quantities of form work.

c. Pipe culvert and slab culvert.

d. Earthwork (for a road, Railway, Canal or a small dam)

C) Writing Detail specifications of any two items Work

Form the items of works in (A) above

D) Analysis of Rates

For the two Items of Works in (A) above based on the prevailing market rates of various items and labour involved.

E) Valuation reports

Of a residential buildings using the format given in the O-1 form

F) Preparation of draft of tender notice

For the Work for which Detailed Estimate is Prepared.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VI)

Laboratory-III

CEL 418 EARTHQUAKE ENGINEERING

Teaching Scheme: P: 2hrs/week **Credit: 1**

List of Experiments (Any 8)

1. Vibration transducers and elementary data processing.
2. Free vibration characteristic of structural systems-natural frequency and damping ratio.
3. Harmonic forced vibration response of structural models and frequency response functions.
4. Dynamic vibration absorber.
5. Prototype testing and system identification.
6. Vibration isolation of a secondary system.
7. Dynamics of a four storied building frame with and without an open ground floor
8. Dynamics of one-span and two-span beams.
9. Earthquake induced waves in rectangular water tanks
10. Dynamics of free-standing rigid bodies under base motions
11. Seismic wave amplification, liquefaction and soil-structure interactions.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (CIVIL ENGINEERING) (Semester VI)

Laboratory-III

CE 419 REPORT ON FIELD TRAINING

Teaching Scheme: ---- **Credit: 1**

The students are required to undergo training in any area related to Civil Engineering as mentioned in the Seminar for 30 working days beyond the academic schedule between the completion of T.Y. (Civil Engineering) Part-I and Final Year B. Tech. (Civil Engineering) Part-I term end. Students shall submit the report of the field training taken and necessary certificate from the organization where such training is undertaken.

Assessment will be done by the panel of internal examiners.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII)

AUDIT COURSE IV

AC 416 PROFESSIONAL ETHICS

Teaching Scheme **No Credits**

Lectures: 2 hours/week

UNIT 1 **3 hrs**

Engineering Ethics – Moral Issues, Ethical theories and their uses

UNIT 2 **3 hrs**

Engineering as Experimentation – Code of Ethics

UNIT 3 **3 hrs**

Engineer's Responsibility for Safety

UNIT 4 **3 hrs**

Responsibilities in Rights

UNIT 5 **3 hrs**

Global issues of engineering ethic

UNIT 6 **3 hrs**

Introduction to Entrepreneurship awareness and Development: Functions -why men become economic innovators –Various Assistance Programmes for Small Scale and large Scale Industries through agencies, like IDBI, IFC, ICICI, NSIC, SFC, SIDCO and DIC.

REFERENCE BOOKS:

1. Agarwal A. N., "Indian Economy", Vikas Publishing House Pvt. Ltd., New Delhi.
2. Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
3. Datta R. and Sundharam, "Indian Economy", K. P. M., S. Chand & Co. Ltd., New Delhi
4. Seth, M. L., "Principles of Economics", Lakshmi Narain Agarwal, Agra.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VIII)

CE 421 DESIGN OF RCC STRUCTURES - II

Teaching Scheme: L: 3 hrs/week **Credits: 4**

T: 1 hr/week

UNIT 1 **6 hrs**

Basic concepts, materials, various pretensioning and post tensioning systems, concept of losses.

UNIT 2 **7 hrs**

Concept of cable profile, Analysis of continuous beams of two spans, Multistoried frames analysis using substructure frame method, Analysis for lateral loads using cantilever and portal method,

UNIT 3 **6 hrs**

Design of multistoreyed building using design aids, computer codes for all loads including wind and earthquake loads.

UNIT 4 **7 hrs**

Design of cantilever and counterfort retaining wall for all loads including surcharge etc. T and L shapes.

UNIT 5 **6 hrs**

Design of combined footings, Rectangular footing both slab and L beam type for two columns only.

UNIT 6 **7 hrs**

Design of Ground Water Tanks and Overhead Tanks, roof, base and supporting structure, Circular tanks with flexible joints at base, Circular tanks with rigid joints at base, Rectangular water tanks, Design shall be based on approximate method and IS Code 3370 (Revised)

Reference Books

1. Krishnaraju N,, “Advanced Design of Structures”,
2. Lin T. Y., “Design of Prestressed Concrete Structures”,
3. Roy and Sinha, “Design of R. C. Structures”,
4. Shah V.L. and Karve S.R., “Design of Multistoried Buildings (G+3)”,
5. IS 456 (2000), Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi
6. IS:1893 (2002), Indian Standard Criteria For Earthquake Resistance of Structures (Part I): General Provisions and Building (Fifth Revision), Bureau of Indian Standards, New Delhi
7. I.S. 875 and IS 3370

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VIII)

CE 422 TOWN AND COUNTRY PLANNING

Teaching Scheme: L: 3 hrs/week **Credits: 3**

UNIT 1 6 hrs

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.

UNIT 2 7 hrs

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.

UNIT 3 6 hrs

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-clasification of parks-park systems-park 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.

UNIT 4 **7 hrs**

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 pr4oblem of existing towns –Peculiarities of traffic.

UNIT 5 **6 hrs**

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.

UNIT 6 **7 hrs**

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

Reference Books :

1. DVan M/s, “The urban pattern city planning and design”,
2. Harvey M. Rubenstain , “A Guide to site and Environmental planning”, Newyork.
3. John Rate life, “An Introduction to town and country planning”, London
4. Michael Hord, “Remote sensing methods and application”, John Wiley and Sons, New York, 1986.
5. Rangwala K. S. and Rangwala P. S., “Town Planning ”, Charotar Publishing House,15th Edition,1999.
6. Ramegowda K A., “Urban and regional planning”, University of Mysore
7. National Building Code of India- Part-III.
8. Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws.
9. Time saver standards for site planning, Mc Graw Hill Book company
10. The art of home landscaping, Mc Graw Hill Book company

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VIII)

CE 423 CONSTRUCTION PRACTICES

Teaching Scheme: L: 3 hrs/week **Credits: 3**

UNIT 1 **4 hrs**

Introduction -Conceptual planning of new project, site access and services, Mechanical v/s Manual construction.

UNIT 2 **8 hrs**

Excavation in Earth : Earth moving equipments - Tractors, Bulldozers, Scrappers, Power shovel, Hoes, simple numerical problems based on cycle time and production rates.

Drag line, Clamshell, Trenchers, Compactors- types and performance, operating efficiencies, lifting capacities,

UNIT 3 **7 hrs**

Excavation in hard rock: Rippers, jack hammers, drills, compressors and pneumatic equipments

Blasting explosives, detonators, fuses, Drainage in excavation – necessity and methods of dewatering.

UNIT 4 **6hrs**

RMC plant, layout and production capacity.

Grouting, Shotcreting, under water concreting.

Slip formwork

UNIT 5 **8 hrs**

Prefabricated construction: Relative economy,

Steel construction: Planning and field operations, Erection equipments

Floating and dredging equipments.

Asphalt mixing and batching plant (Hot mix plant), Sensor Paver for rigid roads, Crushing plants

Belt conveyers, cableways - Need and Construction methods

UNIT 6 **6 hrs**

a) Diaphragm Walls – Purpose and Construction Methods

b) Safety measures in construction, prevention of accidents

C) Introduction to Disaster management

Reference Books:

1. Baron Thomas, “Erection of Steel Structures”,
2. Boyes R.G.H., “Structural and cut off Diaphragm walls”, Applied Science Publishers Ltd., London.
3. Day, “Construction Equipment Guide”,
4. Hajnal I, I Marton, F. Regele A. Wiley, “Construction of Diaphragm Walls”, Interscience Publication, John Wiley and Sons.
5. Peurifoy R. L ., “Construction, Planning, Equipment and methods”, McGraw hill book co New Delhi
6. Prof. Ataev S. S., “Construction Technology”, Mir Publishers, Mascow.
7. Quin, “Planning and Construction of Docks and Harbors”
8. Singh Jagman, “Heavy Construction – Planning, Equipment and methods”, Oxford and IBH publishers, New Delhi
9. Stubbs, “Hand Book of Heavy Construction”
10. Taylors, “Reinforced Concrete Bridges”
11. Varma Mahesh, “Construction Equipment”, Metropolitan book Co , New york
12. Wadel, “Concrete Construction Hand Book”

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VIII)

CE 424 MAJOR PROJECT (PHASE-II)

Teaching Scheme: P: 2 hrs/week **Credit: 4**

Methodology of Evaluation

During the Second Stage of the Project Students would present their project work completed based on the formulation they have presented during first stage. Based on the literature review and project work carried out during second stage of the project student would write a report which would give a review of literature, problem formulation and methodology adopted and the findings of the project work.

The project report would be presented through a seminar which would be evaluated by a panel of internal examiners. During evaluation of the project specific attention would be given to find out the contribution of each team member of the project team.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VIII)

Laboratory-I

CEL 425 STRUCTURAL DESIGN AND DRAWING - III

Teaching Scheme: P: 2hrs/week **Credit: 1**

A) Assignments

At least 6 assignments would include design calculations and hand sketches in sketch books for the design work carried out for assignments.

B) Design Project on Prestressed Concrete

Minimum three half imperial sheets based on project of RCC

C) Design Project on Advanced Design of RCC Structures

Minimum three half imperial sheets based on project on Advanced Design of RCC Structure.

D) Analysis and Design of Small Structure Using Computer Programme

Analysis of small RCC structure using software such as STAAD.PRO, STRUD, ETABS, etc. would be carried out and report on analysis and design would be submitted as a part of Laboratory work.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 430 ADVANCED ENVIRONMENTAL ENGINEERING

UNIT 1 **7 hrs**

Meteorological Aspects:

Parameters influencing air pollution, measurement of parameters plume behavior, transport, and diffusion. Formulae for stack heights, Gaussian diffusion models for finding ground level concentration. Design problems of height of chimney and ground level concentration.

UNIT 2 **7 hrs**

Sampling and Analysis:

Air Pollution survey, Basic and statistical considerations of sampling sites, Devices and methods used for sampling gases and particulars, Stack sampling, Iso kinetic sampling Analysis of air samples, Chemical and instrumental methods, Ambient air quality standards and emission standards

UNIT 3 **7 hrs**

a) Chemistry of air pollution: Photochemistry of air pollution, Photochemical smog reactions involved in its formation, Factors influencing its reactions.

b) Effects of Air Pollution: Effects on man, animals, vegetation and property, Economics of loss due to pollution, Episodes, Air Pollution index.

c) Odors: Sources, measurement and control

UNIT 4 **7 hrs**

a) Control of Pollution: By process modification, Change of raw materials, Fuels, process equipment and process operation by use of air pollution control equipments, For particulate pollutants, Air Pollution control by using Equipments, Design of control equipments as ESP, Scrubber, Bag filter, Cyclones etc Control of gaseous pollutants, Absorption devices, Adsorption Devices, Combustion devices, Condensation devices

b) Land use planning: As a method of air pollution control

c) Air Pollution Control by Legislation and regulation: The Environment (Protection) act, 1986, Emission standards for Stationary sources and mobile sources.

UNIT 5 **7 hrs**

a) Economics of air pollution control:

Cost / benefit ratio, optimization

b) Environmental Impact Assessment:

Definition, Broad Goals, Objectives, Phases in EIA, Contents of Application form, Advantages and Disadvantages of EIA, Environmental management plan,

Environmental Impact of Industries, Urbanization and Agricultural activities.

UNIT 6 **7 hrs**

a) Vehicular Pollution

Sources of pollution, Characteristics of exhaust gases, Traffic problem in major Cities, Control Techniques. Fuel Modification, Bio Diesel, Ethanol, Modifications in Engine Design, Catalytic Converter, Euro Standards

b) Noise Pollution

Sources. Noise characteristics, measurement of noise, Effects of noise, Control of noise.

Reference books

1. Muralikrishnan Kaushal and Company Kakinada A.P., "Air Pollution", KVSG
2. Canter, "Environment Impact Assessment", Mc Graw Hill Publications.
3. G. J. Gau, C. D. Wooten, "Environment Impact Assessment", Analysis Handbook, McGraw Hill
4. Martin Crawford, "Air Pollution Control Theory", T M H Edition, 1980.
5. Perkins, "Air Pollution", McGraw-Hill Edition, 2000
6. Rao M.N., "Air Pollution", Tata Mc Grahill, 1989 edition

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 431 SYSTEMS APPROACH IN CIVIL ENGINEERING

UNIT 1 **7 hrs**

System Concepts, System Parameters, Objectives and Constraints

System Classifications, system cycle, open and closed systems, Identification of Civil Engineering Systems and their methods of analysis, Mathematical representation of a system, Introduction to Single variable optimization, Multi variable optimization with no constraints, Multivariable optimization with equality constraints, Multivariable optimization with inequality constraints, concave and convex functions, regions and sets

UNIT 2 **7hrs**

Linear Programming

Applications of Linear Programming, standard form of a Linear Programming Problem, Solution of a system of linear simultaneous equations, Pivotal reduction of a general system of equations, Simplex Method, Two Phase Method, Method of Big-M, Sensitivity or Post Optimality Analysis, Primal Dual Relations

UNIT 3 **7 hrs**

Allocation Problem, Transportation Problems, Assignment Problems, Queuing Theory, Simulation, Sequencing

UNIT 4 **7 hrs**

Non-Linear Programming

Unconstrained Programming, One Dimensional Search Techniques, Dichotomous, Fibonacci, Golden Section, Multivariable Problems, Gradient Techniques, Steepest Ascent/Descent Technique, Newton's Method, Quasi-Newton‟s Method, Secant Method

UNIT 5 **7 hrs**

Constrained Optimization and Dynamic Programming

Lagrangian Multiplier Technique, Kuhn-Tuckers Conditions, Penalty Function Methods, Principle of Optimality, Recursive Equation

UNIT 6 **7 hrs**

Capitalization, Annuity, Benefit Cost Analysis, Games Theory and its Application to Construction Management, Replacement Models

Reference Books

1. Jhamb L. C., "Quantitative Techniques",
2. Rao S. S., "Optimization Theory and Applications", Wiley Eastern, New Delhi
3. Taha Hamdy, "Operations Research - An Introduction", Pearson Education Asia
4. Vanderplatts G. N., "Numerical Optimization Techniques for Engineering Design with Applications", McGraw Hill
5. Wagner, "Principles of Operations Research",

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 432 MATRIX ANALYSIS OF STRUCTURES

UNIT 1 **5 hrs**

Introduction

Matrix methods for skeletal structures, Finite-Element Method, Basic considerations of structural analysis, Boundary conditions, Reciprocal theorems, Displacement Method, Stiffness relationships

UNIT 2 **6 hrs**

Matrix Displacement method

Bar element with axial force, Bar structure stiffness matrix, Bar element subjected to torsion, Stiffness matrix of a beam element, Assembly of the structure stiffness matrix

UNIT 3 **7 hrs**

Plane Frames

Pin-jointed frames, Rigid jointed frames, Neglect of axial strain for rigid jointed frames, inclined supports, Bandwidth of stiffness matrix, Member Stiffness Relations in the Local Coordinate System, Coordinate Transformations, Stiffness in the Global Coordinate system

UNIT 4

Other kinds of Loading **5 hrs**

Loading between joints, Effects of temperature change and lack of fit

UNIT 5 **5 hrs**

Space Frames

Grid structures, Ball-jointed space frames, Rigid-jointed space frames, Structure Stiffness Relations

UNIT 6 **7 hrs**

Program for Framed Structures

Flow Charts, Continuous Beam Program, Plane Truss Program, Plane Frame Program, Space Truss Program

Reference Books

1. Dawe D. J., "Matrix and Finite Element Displacement Analysis of Structures", Oxford Uni Press, 1984
2. Kanchi M. B., "Matrix Methods of Structural Analysis", Wiley Eastern Ltd. 1993
3. Kassimali Aslam, "Matrix Analysis of Structures" , Brooks/Cole Publishing Co.,1999
4. Meek J. L., E and FN, "Computer Methods in Structural Analysis", Spon Publ.1995
5. Weaver and Gere , "Matrix Analysis of Framed Structures", CBS Publ.1986

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 433 REMOTE SENSING AND GIS APPLICATIONS

UNIT 1 **6 hrs**

Introduction – EMR Spectrum

Energy – electromagnetic radiation, Radiation principles, Electromagnetic spectrum, Energy interaction with atmosphere, Atmospheric windows.

UNIT 2 **8 hrs**

Energy Interactions

Energy interaction with earth surface feature, Spectral vs Diffuse reflectance, Spectral signature of vegetation, water and soil, Ideal Remote Sensing, Real remote sensing, Multi-concept of remote sensing.

UNIT 3 **7 hrs**

Sensor system

Various types of platforms, Different types of sensors, Indian remote sensing systems, Data acquisition Photographic Remote Sensing, Digtal images, Data products and interpretation – various data products characteristics, Principles of interpretation, Ground control points, Ground truth

UNIT 4 **6 hrs**

Remote sensing characteristics

Spatial, spectral, radiometric and temporal resolution, Thermal sensors, Signal Noise Ratio, Fundamentals of microwave remote sensing

UNIT 5 **8 hrs**

Digital Image Processing

Operations involved, Source of image acquisition, Data preprocessing – atmospheric, radiometric, geometric corrections.

Image enhancement

Histograms, Density slicing, Grey level mapping, Contrast stretching, Filtering, Principle component analysis, Basic pattern recognition concepts, Discrimination Functions

UNIT 6 **7 hrs**

GIS

Definition, functions of GIS, Types of data – spatial, non spatial, point, line polygon, vector and raster database, Spatial databases, Coordinate systems and georeferencing,

Interpolation methods – Deterministic and Statistical, Strategies for development, implementation and management of GIS

Reference Books

1. Agarwal C.S. and Garg P.K., "Textbook on Remote Sensing in Natural Resources Monitoring and Management", Wheeler Publishing, Allahabad.
2. Keith P.B. and Thompson et al., "Remote sensing and water resources management", American Water Resources Association, Urbana Illinois
3. Lillesand T.M. and Kiefer R.W., "Remote sensing and Image interpretation", John Wiley and Sons, New York.
4. 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
5. Sweain P.H. and Davis S.M., "Remote sensing – The quantitative approach", McGraw Hill Publications, New York

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 434 HUMAN RESOURCE MANAGEMENT IN CONSTRUCTION

UNIT 1 **5 hrs**

Introduction, Nature and scope of HRM, HRM: functions and objectives of HRM, HRM model, evaluation of HRM, need of HRD in the context of globalization

UNIT 2 **7 hrs**

Human Resource Planning: Nature and importance of HRP, Factors affecting HRP, Planning process

Manpower calculations: techniques of manpower planning for company project, Various HRD parameters, functional skills, supervisory skills, entrepreneurship skills.

UNIT 3 **7 hrs**

Personnel Management**:** Concept of Personnel Management, Role and function of personnel Manager, Necessity of Personnel Management, Role of Personnel Manager.

UNIT 4 **9 hrs**

Recruiting Human resources: Nature, purpose and importance of recruitment, Factors governing recruitment, Recruitment process

Selecting Human Resources: Organisation for selection, selection process, barriers to effective selection, selection in India

Inducting and Placing: Evaluation of orientation program, Problems of orientation, typical orientation program.

UNIT 5 **7 hrs**

Training: Nature of training and development, Inputs in training and development, gaps in training, the training process in various construction companies.

Remuneration: Remuneration of personnel, Factors Influencing employees remuneration, various method of deciding the remuneration wage policy in India Job evaluation, Performance appraisal, Merit rating.

UNIT 6 **7 hrs**

Motivation Perspective: Motivation, importance of motivation, theories of motivation comparison of domestic HRM and IHRM, Managing international HR activities.

Labour laws, Labour legislation

Reference Books:

1. Aswathappa K, “Human Resource Management”, Tata McGraw Hill, Vth Edition, 2008
2. DeNisi A.S., Griffin R.W., “Human Resource Management”, Biztantra Publishers, II Edition, 2009
3. Loosemore M., Dainty A., Lingard H., “Human Resource Management in Construction Projects”, Spon Press, 2003
4. Monappa A, "Personnel Management", Tata McGraw Hill, New Delhi, 1997
5. Rao T, "HRD in the New Economic Environment", Tata McGraw Hill
6. William J Bruns Jr. "Performance Measurement, Evaluation and Incentives", Tata McGraw Hill.
7. NICMAR Publication on - HRD in the Construction Industry - papers and proceedings of the 5th National HRD round table in the Construction Industry, Pune - March - 2000.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 435 ADVANCED ANALYSIS OF STRUCTURES

UNIT 1 **7 hrs**

Basic Equations of Thin Plate Theory

Assumptions, Slopes and Curvatures of a bent plate, Strain-Curvature relations, Moment Curvature relations. Governing differential equation for rectangular plate, Various boundary conditions

UNIT 2 **7 hrs**

Bending of Isotropic Rectangular Thin Plates

Navier solution for all round simply-supported rectangular plate under sinusoidal load, uniformly distributed load, patch load and point load, Levy solution for rectangular plate with various boundary conditions under uniformly distributed load.

UNIT 3 **7 hrs**

Approximate Method of Analysis for Rectangular Plates

Principles of virtual work and minimum potential energy, Rayleigh – Ritz Approach for all round simply-supported and all round clamped rectangular plate under uniformly distributed load.

UNIT 4 **7 hrs**

Numerical Method of Analysis for Rectangular Plates

Difference equations, Finite Difference Approach for all round simply-supported and all round clamped rectangular plate under uniformly distributed load.

UNIT 5 **7 hrs**

Response of SDOF System to General Dynamic Loading

Duhamel's integral. Direct integration method. Fourier analysis for periodic loading.

UNIT 6 **7 hrs**

Lumped Parameter MDOF System

Orthogonality conditions, Natural frequencies by inverse iteration method, Dynamic response by mode superposition.

Reference Books:

1. Chandrashekhara K., "Theory of plates", Universities press.
2. Chopra A.K., "Structural Dynamics and introduction to earthquake engineering".
3. Smith J. W., "Vibration of structures, Application in civil engineering design", Chapman and Hall
4. Timoshenko S. and Krieger W., "Theory of plates and shells", Mc – Graw Hill.
5. Ugural Ansel C., "Stresses in Plates and Shells", Mc Graw Hill.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 436 ADVANCED DESIGN OF STRUCTURES

UNIT 1 **7 hrs**

Design and detailing of Deep Beams as per IS 456:2000, Comparison with design by British code and American code.

UNIT 2 **7 hrs**

Design of Ribbed (voided) Slab and Grid Floors.

UNIT 3 **7 hrs**

Design of Flat Slabs.

UNIT 4 **7 hrs**

Design of Shear Walls.

UNIT 5 **7 hrs**

Intel Tanks

UNIT 6 **7 hrs**

Design of Cast-in-Situ Beam-Column Joints

Reference Books:

1. Dayaratnam P., “Advanced Reinforced Concrete Design”.
2. Verghese P. C., “Advanced Reinforced Concrete Design”, 2nd Edition, PHI Learning Private Ltd, New Delhi, 2009.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 437 PLUMBING SERVICES

UNIT 1 **5 hrs**

Introduction to codes and standards

Approvals, AHJ, alternative materials, minimum standards, sewers required, industrial wastes, workmanship, prohibited fittings and practices, water conservation, protection of pipes and structures, waterproofing, rat proofing, hangers and supports, trenching, types of joints.

Architectural and Structural Coordination

Local municipal laws relating to plumbing and basic information on fire static water requirements. Spaces required for various sanitary facilities, plumbing shafts, water tanks and pump rooms, centralized hot water systems, coordination with the architects. Structural parameters such as sunken toilets, location of columns and beams, post-tension slabs, importance of ledge walls.

UNIT 2 **7 hrs**

Plumbing Terminology

Definitions for most words can be found in a dictionary, but there are technical or trade terms which take on a special meaning when used in relation to plumbing.

Plumbing Fixtures and Fixture Fittings

Plumbing fixtures, water conserving fixtures, water closets, bidets, urinals, flushing devices, lavatories, bath/shower, kitchen sinks, water coolers, drinking fountain, clothes washer, mop sink, overflows, strainers, prohibited fixtures, installation standards, strainers, floor drains, floor slopes, location of valves, hot water temperature, and table of minimum plumbing facilities.

UNIT 3 **8 hrs**

Traps and Interceptors

Traps required, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps, clarifiers, grease interceptors, sizing, FOG disposal, oil and sand interceptors.

Indirect Waste

Air-gap, food establishments, sink traps, dish washers, drinking fountains, waste receptors, sterile equipment, appliances, condensers, chemical wastes, point of discharge, venting. Introduction to pipe sizing.

Vents

Vent requirement, trap seal protection, materials, vent connections, flood rim level, termination, vent stacks, water curtain and hydraulic jump, horizontal and vertical wet venting, combination waste and vent system, cleanouts, venting of interceptors. Introduction to vent sizing, sizing of combination vents etc.

UNIT 4 **7 hrs**

Sanitary Drainage

Preamble, pipe materials and jointing methods, special joints, fixture connections (drainage), hydraulic jump, change in direction of flow, T and Y fittings, cleanouts, pipe grading, fixtures below invert level, suds relief, testing, building sewers, testing, sumps and pumps, public sewers, sewage disposal. Introduce DFU, sizing of horizontal and vertical pipes.

Storm Drainage

Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters/channels/scuppers, window areaway drains, roof drains, strainers, leaders, conductors and connections, siphonic drains, underground drains, materials, traps required, prohibited installations, testing. Introduction to sizing of channels, rainwater down takes, underground drains. Introduction to rain water harvesting.

UNIT 5 **7 hrs**

Water Supply

Preamble, sources of water, potable and non-potable water, reclaimed water, water storage, treatment, hot and cold water distribution system, backflow prevention, air gap, cross connection control, pipe materials and jointing methods, pressure controls, unions, thermal expansion, types of valves, installation and testing, disinfection, protection of underground pipes, color codes and arrow marking. Introduce WSFU,
sizing calculations.

Solar Hot Water

Introduction to solar water systems. System components, panels, hot water tanks, electrical backup, safety measures, auto controls, hot water supply and return systems, various insulating materials, control valves, introduction to other methods of hot water generation.

Gray-water Systems

Definition of gray water, specifications and drawings, total gray water discharge, soil absorption, holding tanks, valves and piping. Reclaimed water systems, definition of reclaimed water, pipe identification, installation, signs, valves, cross connection, inspection and testing, approved uses.

UNIT 6 **6 hrs**

Pumps and HPS

Types of pumps for water supply, heat exchangers, wastewater dewatering and sewage. Pressure boosting and hydro-pneumatic systems shall be elaborated along with the accessories and controls.

Construction Management

Organization charts, inter-organization relations, coordination of other agencies, role of Engineer-in-charge, safety and security, working at heights and confined spaces, accidents reporting. Inventory, material ordering and stacking, testing, record keeping, measurements, and billing. Time and cost analysis, specifications writing, resources planning, takeoff quantities (BOQ), and cost estimates of few plumbing items. Break down activities, activity sequence and activity period for few selected cases.

Reference Books

Uniform Plumbing Code- India (UPC-I), 2008

Illustrated Training Manual (ITM), 2008.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 438 –ADVANCED ENGINEERING GEOLOGY AND ROCK MECHANICS

UNIT 1 **7 hrs**

Introduction

Importance of geological studies in engineering investigations, Precautions necessary to avoid misleading conclusions likely to be drawn while interpreting drilling data with particular reference to R.Q.D. Dependence of design on geological features of project site. Case histories illustrating economics made possible by proper geological studies and wasteful expenditure or difficulties resulting from their neglect.

Engineering characteristics of rocks of major rock formations of India.

Groundwater conditions in Maharashtra

Ground water conditions in Maharashtra with reference to Deccan Trap area.

Waterbearing characters of different type of basalts, volcanic breccias, tachylytic basalts, dykes, fractures, weathering products and older alluvium. Geological factors governing natural recharge. Geological aspects of multiaquifier system, deep drilled tube wells. Geological aspects of conservation of water and artificial recharge, Dependence of success of such schemes as percolation tanks and watershed development on Geological conditions and necessity of Geological studies for such schemes, Study of case histories

Earthquakes

Seismisity in Maharashtra, Earthquakes taken place in the areas of some dams and Geological conditions indicating lack of connection of these reservoirs

UNIT 2 **7 hrs**

Engineering geology of the Deccan Trap Basalts

Factors affecting strength and water tightness. Stability of cuts and ability to stand without support, signficance of commonly occurring features like gas cavities, jointing, weathering, hydrothermal alteration, volcanic breccias, tachylytes, dykes, fractures, faults and their civil engineering significance, Field structures of flows, stratigraphical sequence of flows etc. in various civil engineering projects.

Urban Geology

Influence of Geological factors upon Urban development and planning

Construction Material

Deccan Trap basalts as construction material, Use of compact basalts and amygdaloidal basalts as Rubble for masonry and metal for concrete and pavement quality concrete, Study of case histories

UNIT 3 **7 hrs**

Geology of soil formation

Residual and transported soils, Rock weathering conditions favorable for decomposition and Disintegration, Influence of climate on residual and transported soils in the Deccan Trap area, Nature of alluvium of Deccan Trap rivers and its engineering characters.

Effect of deposition of Calcium Carbonate. Scarcity of sand in the rivers in the deccan trap area

Geophysical Investigations

Seismic and electrical resistivity methods of exploration as applied to engineering investigations.

Rock Mechanics

General principles of rock mechanics, Dependence of physical properties of rocks of Geological Characters, Testing methods, Mechanical properties of Deccan Trap rocks, Calculation of R.Q.D, Joint frequency index, R.M.R., Q system, stand up time calculations. Bieniawsk's Geomechanical Classification, etc.

UNIT 4 **7 hrs**

Foundation treatment:

Foundation investigations during construction for determining the foundation treatment for adverse geological features. Determination of foundation levels / cut off levels for earth dams.

Correction of adverse features by means of grouting, Groutability of rocks.

Consolidation grouting for improving strength of weak and fragmented rocks, Curtain grouting for preventing leakage through foundation rocks, Determining depths and zones of consolidation and curtain grouting, Relation of zones of grouting with height of dams, Foundation treatment for fractures having different manifestation, jointed rocks, tachylytes and dykes, Typical case histories.

UNIT 5 **7 hrs**

Erosion of tail channels

Erosion of tail channel as a factor in selecting site for spillway, Causes of rapid erosion of tail channels of side spillways. Geological conditions leading to tail channel erosion, Case histories.

Bridges

Investigation for bridge foundations, difference in objectives of investigation of dam foundation and investigation of bridge foundation, Computing safe bearing capacity (S.B.C.) for bridge foundations based on nature and structures of rock, Foundation settlements, Case histories

Dams

Strength and water tightness of Deccan Trap rocks from foundation point of view.

Physical properties such as compressive strength, water absorption etc. of basalts.

Effect of weathering and hydrothermal alteration on the engineering properties of rocks.

Deterioration of rock masses on exposure to atmosphere and suitable treatment for such rocks,

Illustrative case histories.

UNIT 6 **7 hrs**

Tunnelling

Variation in methodology of investigation for different types of tunnels for different purposes; location, spacing, angles, and depths of drill holes suitable for different types of tunnels, Difference in behavior of basalts because of jointing as exemplified by compact basalts and amygdaloidal basalts, Difficulties involved by tachylytes, volcanic breccias, tuffs, intertrappean beds, fractures, dykes, hydrothermal alteration, flow contacts and unfavourable field characters. Computing structural discontinuities in rock masses, R.Q.D., joint frequency index, R.M.R. values, Q System, standup time. Limitations of these, dependence of protective measures such as guinitting, rock bolting, shortcreting, permanent steel supports, lagging, concreting and contact grouting above permanent steel supports on Geological conditions. Suitability of T.B.M. and road headers, Experience of some important tunnels in Deccan Trap rocks

One field visit to study the above contents.

Reference Books:

1. Bieniawski Z.T., “Engineering classification of jointed rock masses”.
2. Goodmann, “Principles of Rock Mechanics”.
3. Gupte R.B., “A Text Book of Engineering Geology”, P.V.G. Publications, Pune
4. Jaeger, “Rock Mechanics in Engineering”
5. P.W.D. Hand Book – Chapter 6, Part II, Engineering Geology Government of Maharashtra

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 439 ADVANCED GEOTECHNICAL ENGINEERING

UNIT 1 **7 hrs**

Soil as Engineering Material

Typical Indian soil deposits with their engineering characteristics, deciding suitability of soil as a construction material through evaluation of soil properties, Field identification and IS classification of soil, Significance of Consistency Limits and Indices, Clay Minerals – Structure, Clay Water Relationship, Clay Particle Interaction, Soil Structure and Fabric

UNIT 2 **7 hrs**

Shear Strength

Shear strength behavior of clayey soil under different drainage conditions, shear strength of the sandy soils under different drainage conditions, skempton's pore pressure parameters and their determination, stress path method, Stress-Strain behaviour of soil

UNIT 3 **7 hrs**

Soil Retaining Structures

Failure modes of gravity and flexible retaining walls, design of gravity and rigid cantilever retaining wall, Introduction to design of flexible retaining wall, drainage and dewatering of retaining walls, Introduction to reinforced earth wall, gabions, seismic forces.

UNIT 4 **7 hrs**

Stability of Slopes

Finite slopes, stability analysis – method of slices, Bishop‟s method, Taylor's Stability Number and stability curves.

UNIT 5 **7 hrs**

Introduction to Rock Mechanics

Index properties of rock, RQD, Laboratory tests - unconfined compressive strength, point load test, tri-axial test, Insitu tests, Rock Mass Rating, Engineering

Classification of rock, Modes of failure of rocks, Stress-Strain curves, Shear Strength, Mohr's Coulomb failure criteria.

UNIT 6 **7 hrs**

Introduction to Modeling in Geotechnical Engineering

Analytical, Physical and Geotechnical Centrifuge Modelling.

Reference Books

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill International
2. Das B.M., "Advanced Soil Mechanics", Tata McGraw Hill
3. Das B. M., "Principles of geotechnical engineering", Cengage Learning (Thompson)
4. Dr. K.R. Arora, "Soil Mechanics and foundation Engineering", Standard Publishers Distributors.
5. Muni Budhu, "Soil Mechanics and Foundations", John Wiley and Sons Inc
6. Ranjan Gopal and Rao, "Basic and Applied Soil Mechanics", New Age International Publishers
7. Winterkorn and Fang, "Foundation Engineering Hand Book"

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 440 – WATER RESOURCES PLANNING AND MANAGEMENT

UNIT 1 Introduction **7 hrs**

Introduction, National water policy, Development stages, reservoir yield and capacity, reservoir sediment distribution and various methods, flood routing and various methods.

UNIT 2 Reservoir Planning (Irrigation) **7 hrs**

Planning for irrigation, evapotranspiration, methods, crop irrigation requirement, reservoir regulation, conjunctive water use planning, Reservoir operation,

UNIT 3 Reservoir Planning (Hydropower) **7 hrs**

Planning for hydropower, flow duration curve and load duration curve, Planning for run-of-river plant, planning of storage plant, base load plant, peak load plant and its planning.

UNIT 4 Systems Analysis in water resources planning **7 hrs**

Concepts, optimizing techniques, conventional and evolutionary, simulation, applications of soft computing techniques for water resources planning and management.

UNIT 5 Water resources economics **7 hrs**

Water resources economics- cash flow diagram, discounting Factors, discounting techniques-benefit- cost ratio, internal rate of return, Annual cost and Present worth method, Evaluation of discounting techniques.

UNIT 6 Basin Planning and management **7 hrs**

Water balance of a basin, integrated river basin development, River water disputes, Inter-basin river water transfers, Environmental considerations.

Reference Books:

1. Goodman, A.S., “Principles of Water Resources Planning”, Prentice Hall Inc., New Jercy, 1984.
2. James, L.D. and Lee, R.R., “Economics of Water Resources Planning”, McGraw Hill, 1971.
3. Linsley, R.K. and Franzini, J.B., “Water Resources Engineering”, Third Edition, Mc Graw Hill,Inc.
4. Vedula, S. and Majumdar, P. P., “Water Resources Systems. Modeling Techniques and Analysis”, TATA Mc Graw Hill, 2005
5. Warnic, C.C., “Hydropower Engineering”, Prentice Hall Inc., New Jercy, 1984.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 441 INTRODUCTION TO FINITE ELEMENT ANALYSIS

UNIT 1

Basic Concepts **5 hrs**

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

UNIT 2

One-dimensional Finite Elements **5 hrs**

Bar Element, Beam Element, Consistent nodal loads, Element displacement fields, Shape functions and interpolation polynomials

UNIT 3

Two-dimensional Elements **6 hrs**

Equations from theory of Elasticity, Potential energy for the continuum, General finite-element formulation, Triangular elements, CST, LST elements, Rectangular elements.

UNIT 4

Method of Weighted Residuals **6 hrs**

Method of Weighted Residuals, The Galerkin Finite Element, Element Formulation, Application of Galerkin‟s Method to Structural Elements, Bar Element, Beam Element.

UNIT 5

Three-dimensional Analysis **8 hrs**

Tetrahedral elements, Constant strain tetrahedron Triangular Elements, Rectangular hexahedral Elements, Axisymmetric Elements, Isoparametric Formulation, Numerical Integration: Gaussian Quadrature

UNIT 6

Applications in Solid Mechanics **6 hrs**

Plane-stress, Plane-Strain Formulation, Isoparametric formulation for Plane Quadrilateral Element, Axisymmetric stress Analysis, Strain and Stress Computation

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. Cook R.D., “Concepts and Applications of Finite Element Analysis”, John Wiley, New York 1995
4. Belegundu A.D. And Chandrupatla T.R., “Finite Element Methods in Engineering”, Prentice hall India 1991
5. Reddy J.N, “Finite Element Methods”, John Wiley and sons 1982
6. Buchanan G.R., “Finite Element Analysis”, McGraw Hill Publications New York 1995

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 442 ADVANCED FOUNDATION ENGINEERING

UNIT 1 **7 hrs**

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

UNIT 2 **7 hrs**

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.

UNIT 3 **7 hrs**

Well foundations

Depth of a well foundation, forces acting, lateral stability – Terzaghi‟s analysis, IRC method, elastic theory method, ultimate soil resistance method.

UNIT 4 **7 hrs**

Flexible retaining structures and Cofferdam

Cantilever Sheet pile – granular soil, cohesive soil, Anchored sheet pile/bulkhead – free earth support method, fixed earth support method, common type of cofferdam, design aspect of cofferdam.

UNIT 5 **7 hrs**

Introduction to Ground Improvement Techniques

Stabilization, vibrotechnique, 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.

UNIT 6 **7 hrs**

Foundations on Expansive Soil

Identification of expansive soil, Characteristics and problems associated with these soils, chemical composition, clay minerals, swelling potentials and its measurements, swelling pressure, detrimental effects, measures to control its detrimental effects, design of foundations on expansive soils.

Reference Books

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill International
2. Das B. M., "Principles of foundation engineering", Cengage Learning (Thompson)
3. Dr. K.R. Arora, "Soil Mechanics and foundation Engineering", Standard Publishers Distributors.
4. Gopal Ranjan and Rao, "Basic and Applied Soil Mechanics", New Age International Publishers
5. Kaniraj S.R., "Design aids in soil mechanics and foundation engineering", Tata McGraw Hill Publishing Company Ltd.
6. Muni Budhu, "Soil Mechanics and Foundations", John Wiley and Sons Inc
7. Tomlinson M.J., "Foundation Design and Construction", ELBS Publication
8. Winterkorn and Fang, "Foundation Engineering Hand Book",

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 443 FIBER REINFORCED CEMENT COMPOSITES

UNIT 1 **7 hrs**

Introduction, Historical Development, Interaction between fibers and matrix. Basic concepts and mechanical properties like tension, bending. Experimental Evaluation of conventional Fiber –cement composites .and High –volume Fraction Fiber Composites Study of various models for the prediction of Failure stress

UNIT 2 **8 hrs**

Properties of constituent materials Cement, aggregates Admixtures and various fibers mixing proportions ,mixing and casting procedures.

UNIT 3 **7 hrs**

Properties of freshly mixed FRC containing coarse aggregates, Properties of hardened FRC, Testing of FRC under Fatique and impact loading Creep, Shrinkage and long term performance ,Plastic and early drying shrinkage.

UNIT 4 **7 hrs**

Advances in Fiber Reinforced cement composites, like Fiber reinforced shotcrete, Glass Fiber Reinforced concrete, Thin sheet products, Slurry infiltrated fiber concrete.

UNIT 5 **6 hrs**

Advances in fiber concrete Mechanics

Elastic Response in tension, Fracture Mechanics approach Linear and non Linear Fracture Mechanics

UNIT 6 **7 hrs**

Future challenges in Fiber reinforced Concrete Technology;

Forces shaping our world, future demand for FRC, Engineering and Environmental considerations, the use of FRC for structural components. Field performance and case studies.

Reference Books

1. P.K.Mehta and Paulo J.M.Monteiro, “Concrete”
2. Neville, “Concrete Technology”.
3. P.N. Balaguru, S.P. Shah, “Fibre reinforced cement Composites”.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 444 ENERGY EFFICIENT AND COST EFFECTIVE BUILDING

UNIT 1 Buildings and Environment **5 hrs**

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.

UNIT 2 Ferrocement, Ferro-concrete and Fibre reinforced composites **8 hrs**

Introduction, Materials, Construction methods, Durability, Mechanical properties, Applications, Design examples, Ferro-concrete, Applications , Design examples

Fibre reinforced cement composites : Materials, Mechanical properties of FRC, Analysis and behaviour, Applications

Fibre reinforced polymer composites : Materials, manufacturing Processes and Applications

UNIT 3 Building blocks and Mortars for Masonry **8 hrs**

Introduction, Stone and Laterite blocks, Burnt clay bricks, Solid and Hollow concrete blocks, Terracotta blocks, Stabilized Mud blocks, Stone masonry blocks, Selection of building blocks.

Lime, Lime pozzolona and combination mortars for masonry, Raw materials, Process, Properties and Uses, Practical aspects

UNIT 4 Introduction to design of load bearing structures **5 hrs**

Stresses in masonry under compression, Factors influencing compressive strength of masonry, Strength of masonry under compression, Bond strength in masonry, Elastic properties, Design of masonry under vertical gravity loads.

UNIT 5 Alternative Roofing Systems **8 hrs**

Concepts in roofing alternatives, Thatch roofs, Filler slab roofs, Filler materials, Composite beam-panel roofs / floors, hollow hourdi/concrete block roofs / floors.

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.

UNIT 6 Concepts of Green Buildings **6 hrs**

Sustainability concepts, Forms of energy, Embodied and Life cycle energy, Energy Efficiency in Building materials. Building Materials from Agro and Industrial waste, Biomass resources, treated thatch, Industrial wastes, Use of industrial wastes, Active and Passive energy systems, Rain water harvesting, Cladding materials.

Reference Books:

1. Balaguru P.N. and Shah S.P., “Fibre reinforced Cement Composites”, McGraw Hill, Inc.
2. Hannant D. J., “Fibre cements and Fibre Concretes”, John Wiley and Sons.
3. Jagadish K.S., Reddy B.V.V., Nanjuda Rao K.S., “Alternative Building Materials and Technologies", New Age International Publishers
4. Neville A.M., “Properties of Concrete”, ELBS, Longman.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 445 ADVANCED WATER AND WASTEWATER TREATMENT

UNIT 1 Fundamentals **5 hrs**

Need for Advanced water and wastewater Treatment

Reactors and Reaction Kinetics: Types of Reactions and Reaction Kinetics

Types of reactors and Principles of Reactor Design

Principles of aeration, Gas-liquid mass transfer, two film theory

UNIT 2 Physical **5 hrs**

Ion Exchange: Process, Ion exchange resins, exchange capacity, ion exchange chemistry and reactions, Applications for hardness and TDS removal, Design of ion exchange UNITs

UNIT 3 Membrane Processes **8 hrs**

Membrane Filtration: Terminology, Process classification, Membrane configurations, Membrane operation for micro filtration, Ultra filtration and Reverse osmosis, Membrane fouling and its control, Application of Membranes.

Electro dialysis: Theory, Area and power requirement, Disposal of Concentrate waste streams.

UNIT 4 Adsorption **6 hrs**

Adsorption processes, causes and types of adsorption, influencing factors, adsorption equilibria and development of adsorption isotherms, activated carbon adsorption kinetics, analysis and design of GAC and PAC contactors.

UNIT 5 Biological Treatment **8 hrs**

Physical, Chemical and Biological processes for Nitrogen and phosphorous removal, Removal of heavy metals.

Anaerobic sludge blanket processes, Design considerations for up flow Anaerobic Sludge Blanket process.

Design of high rate clarifier

Disinfection with ozone: chemistry, modeling, estimation of ozone dosage. UV disinfection: system components, modeling, Estimation of UV dose.

UNIT 6 Constructed wetland **8 hrs**

Wetland and aquatic treatment systems; Types, application, Treatment kinetics and effluent variability in constructed wetlands and aquatic systems, Free water surface and subsurface constructed wetlands, Floating and emergent plants,

Combination systems, Design procedures for constructed wetlands,

Management of constructed wetlands and aquatic systems.

Reference Books

1. Arceivala S.J. and Asolekar, "Wastewater Treatment for Pollution Control and Reuse", Tata McGraw Hill Publication, 2002, 2nd Edition
2. Droste, Ronald L., "Theory and Practice of Water and Wastewater Treatment", John Wiley and Sons Publication, 1997, 1st Edition
3. Peavy, "Environmental Engineering", Rowe and Technologies
4. Metcalf And Eddy, "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 1979, 2nd Edition
5. Sincero. A.P. And Sincero. G.A., "Environmental Engineering", Prentice Hall of India Private Limited, 1996, 1st Edition
6. Weber, "Physico-Chemical Processes of Water Purification",

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 446 ADVANCED CONCRETE TECHNOLOGY

UNIT 1 **7 hrs**

Cement and its types: general, hydration of cement, water requirement for hydration, alkali aggregate reaction.Aggregate: grading curves of aggregates.

Concrete: properties of concrete, w/c ratio, w/b ratio, gel space ratio, maturity concept, aggregate cement bond strength.

UNIT 2 **7 hrs**

Light weight concrete, ultra light weight concrete, vacuum concrete, mass concrete, waste material based concrete, shotcreting, gUNITing, sulphur concrete and sulphur infiltrated concrete, jet cement concrete (ultra rapid hardening), gap graded concrete, no fines concrete, high strength concrete, high performance concrete and under water concreting.

UNIT 3 **7 hrs**

Design of high strength concrete mixes, design of light weight aggregate concrete mixes, design of flyash cement concrete mixes, design of high density concrete mixes

Advanced non-destructive testing methods: ground penetration radar, probe penetration, pull out test, break off maturity method, stress wave propogation method, electrical/magnetic methods, nuclear methods and infrared thermography, core test.

UNIT 4 **7 hrs**

Historical development of fibre reinforced concrete, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres and naturally occurring fibres. Interaction between fibres and matrix (uncracked and cracked matrix), basic concepts and mechanical properties: tension and bending.

UNIT 5 **6 hrs**

Properties of hardened frc, behavious under compression, tension and flexure of steel fibres and polymeric fibres.

GFRC, SFRC, SIFCON-development, constituent materials, casting, quality control tests
and physical properties.

UNIT 6 **6 hrs**

Ferrocement, analysis and design of prefabricated concrete structural elements, manufacturing process of indusrrial concrete elements, precast construction, errection and assembly techniques.

Reference Books

1. Santhakumar, “Concrete technology”, Oxford University Press.
2. Neville A.M. and Brooks, “Concrete technology”
3. Murdock, “Properties of Concrete”.
4. Mehta P.K., “Properties of Concrete”.
5. Shetty M.S., “Concrete Technology”.
6. Balguru P.N. and Shah P.N., “Fiber Reinforced Cement Composite”.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 447 ENGINEERING OPTIMIZATION

UNIT 1 **7 hrs**

Engineering applications, various techniques, single and Multivariate optimization; Linear Programming - Standard form, simplex method, Decomposition principle, applications to structural design problems;

UNIT 2 **7 hrs**

Nonlinear Programming - Unimodal function, Elimination and Interpolation methods;

Unconstrained Optimization Techniques - Direct search methods, Descent methods, Conjugate gradient method;

UNIT 3 **7 hrs**

Constrained Optimization Techniques - Characteristics of the Problem. Direct methods and indirect methods, Convex programming problem;

UNIT 4 **6 hrs**

Optimization in Structural design -Minimum weight and optimum cost considerations, application to Trusses and Frames, design of reinforced beams and slabs.

UNIT 5 **6 hrs**

Classical optimization techniques-differential calculus-Lagrange multipliers, Newton Raphson approximation, Kutin tucker conditions, examples.

UNIT 6 **6 hrs**

Geometric Programming- Calculus viewpoint, polynomials, orthogonality conditions, degree of difficulty, geometric inequality, primal-dual relations, inequality constraints, examples

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

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 448 STRUCTURAL DYNAMICS

UNIT 1 **8 hrs**

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

UNIT 2 **8 hrs**

SDOF system subjected to periodic and impulsive loading, Fourier series loading, Rectangular pulse, Introduction to Frequency –Domain Analysis

UNIT 3 **8 hrs**

SDOF systems subjected to general dynamic loading, Duhamel's integral, Application to simple loading cases, numerical evaluation of response integral, and Piece wise exact method

UNIT 4 **6 hrs**

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

UNIT 5 **5 hrs**

Discrete systems, Fundamental mode analysis, Rayleigh method, Response of MDOF systems to dynamic loading, Mode superposition method, Coupled and Uncoupled equations of motion , Model Contribution

UNIT 6 **4 hrs**

Distributed- parameter Systems, Partial differential equations of motion, Free and forced Vibration, Application to beams in flexure

Reference Books

1. Chopra A.K., "Dynamics of Structures", Dhanapat Rai and sons, New Delhi
2. Mario Paz, "Structural Dynamics", CBS Publication
3. Gosh S. K., "Earthquake Resistant Design of R. C. C. Structures"
4. Clough R. M. and Ponian , "Dynamics of Structures", McGraw Hill co.New Delhi
5. Grover G. R., "Mechanical Vibrations", Roorkee University, Roorkee.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 449 REINFORCED SOIL AND APPLICATION

UNIT 1 Components of Reinforced Soil **5 hrs**

(a) Introduction, Basic mechanism of reinforced earth, practical applications

(b) Basic components of reinforced soil Fill matrix, various forms of reinforcement material and facing elements.

(c) Various forms of Geosynthetic material and their application for various functions

UNIT 2 Mechanism of Reinforced Soils **10 hrs**

(a) Introduction, Materials and their properties: metallic and polymeric material, properties like thickness, mass per UNIT area, uniaxial tensile strength, burst test, soil-geosynthetic friction test, u/v resistance etc. for geotextiles, geomembrane and geogrids.

(b) Mechanism of reinforced soils: modes of failure – rupture, tensile failure, pullout failure

(c) Factors affecting performance and behaviour of reinforced soil: reinforcement, its distribution, soil, soil state, construction factors.

(d) Soil reinforcement interaction, design of spacing and layout

UNIT 3 Bearing Capacity Improvement **8 hrs**

(a) Introduction, Modes of failure

(b) Determination of Forces induced in reinforcement: Location of failure surface,Tension and pullout considerations, Minimum length and curtailment of pullout length of reinforcement

(c) Bearing capacity improvement in soft soils and guidelines for use of geogrids

UNIT 4 Foundations on Reinforced Soil Bed **8 hrs**

(a) Introduction, Applications of reinforced earth to foundation problems.

(b) Analysis of Strip footing on reinforced soil bed : assumptions and analysis, numerical problem

(c) Analysis of isolated column footings on reinforced soil bed, numerical problem

UNIT 5 Reinforced Earth Retaining Walls **8 hrs**

(a) Introduction, components like reinforcement, facing, backfill.

(b) General design principles: internal and external stability concepts, initial size of the structure, external stability check, selection of type of reinforcement, internal stability checks

UNIT 6 Soil Nailing **3 hrs**

(a) Introduction, suitability of nailing.

(b) Nailing technique, types of nails, their placement, facing to the nails and drainage aspects.

(c) Advantages and disadvantages, soil-nail interaction and theoretical design procedure.

Reference books:

1. Babu Sivakumar G L, “Soil Reinforcement and Geosynthetics", Universities Press (India) Pvt Ltd, Hyderabad, 2006.
2. Saran Swami, “Reinforced Soil”, Oxford and IBH Publishing Co. Pvt. Ltd
3. Gulhati S.K., Datta Manoj, “Geotechnical Engineering”, Tata McGraw Hill, New Delhi, 2005.
4. Swami Saran, “Analysis and Design of Substructures”, Oxford and IBH Publishing Co. Pvt. Ltd., 1996.
5. Nayak N. V., “Foundation Design Manual” Dhanpat Rai and Sons, Delhi.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 450 NUMERICAL METHODS

UNIT 1 **6 hrs**

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. …..

UNIT 2 **6 hrs**

Roots of Nonlinear Equations, Simple One-Point Iteration, Newton-Raphson Method, Secant Method, Multiple Roots, System of Nonlinear, Equations.

UNIT 3 **7 hrs**

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.

UNIT 4 **6 hrs**

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

UNIT 5 **7 hrs**

Necessity of statistical approach, review of basic concepts of statistics, Linear Regression: Least Squares Method, Polynomial Regression, Nonlinear Regression.

UNIT 6 **7 hrs**

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.

Reference books:

1. Rao S. S., "Numerical Methods', Tata McGraw Hill Publications, 2002, 3rd Edition.
2. Chapra S.C. And Canale R.P., "Numerical Methods for Engineers", Tata McGraw Hill Publications, 2002, 4th Edition.
3. E. Balguruswamy, "Numerical Methods"
4. Goldberg D.E., "Genetic Algorithm", Pearson Education, 2000, 1st Edition.
5. Gerald. C.F. And Wheatly. P.O., "Applied Numerical Analysis", Addison Wesley, 1994, 5th Edition.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 451 COMPUTER APPLICATION IN CIVIL ENGINEERING

UNIT 1 **6 hrs**

Structural Drafting: Structural drafting and detailed drawings of components design using AutoCAD, AUTOLISP, Application of simple structural steel and R.C.C. elements, drawings of plan elevation of structures.

UNIT 2 **7 hrs**

Computer aided design of steel structures: Development of software for basic structural elements such as beam, column base, gantry girder, using I.S. 800 specification.

UNIT 3 **6 hrs**

Computer aided design of R.C.C. structures: Development of software for basic structural elements such as rectangular beam, T beam, one – way and two – way slabs, columns and isolated column footings using I.S. 456.

UNIT 4 **7 hrs**

Use of software for analysis of structures, preparation of input data, output and interpretation of results, application of software for plane trusses, portal frames.

UNIT 5 **6 hrs**

Use of software for analysis and Design of structures, preparation of input data, output and interpretation of results, application of software for seismic Resistant design of RCC High rise Buildings.

UNIT 6 **7 hrs**

Use of software for analysis and Design of structures, preparation of input data, output and interpretation of results, application of software for wind load resistant design of Transmission towers, High rise Buildings steel buildings.

Reference books:

1. Bhirud L. L., “Matrix Operations on Computer”, Oxford and IBM Pub. Co.
2. Krishnamurthy E. V. and S. K. Sen, “Numerical Algorithm”, Affiliated Best West Press Pvt. Ltd.
3. Madhuji Mukhapadhyaya, “Matrix, Finite Element, Computer and Structural Analysis” Oxford and IBM Pub. Co.
4. Nawy Edward G., “Numerical Concrete, Fundamental approach”, Prentice Hall, New Jersey.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: L: 3 hrs/week **Credits: 3**

CE 452 DESIGN OF CONCRETE BRIDGES

UNIT 1 **6 hrs**

General Basic Bridges forms – beam, arch, suspension, various types of bridges, selection of type of bridge and economic span length, super structure – philosophy, geometric alignment, drainage, road kerb, pile foundation, open well foundation

UNIT 2 **8 hrs**

Design loads for bridges – dead load, live load, IRC loading, wind load, longitudinal forces, centrifugal forces, buoyancy, water current forces, thermal forces, Earthquake load, Impact load, deformation and horizontal forces

UNIT 3 **7 hrs**

Design of R. C. deck slab, beam and slab, T beam, Pigeaud's theory, Courbon's theory, balanced cantilever bridge, box culvert

UNIT 4 **8 hrs**

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

UNIT 5 **6 hrs**

Design of bridge components - Abutments, Wing walls, Piers, Approach slab

UNIT 6 **4 hrs**

Bearing and expansion joints – forces on bearings – Types of bearings, design of unreinforced elastomeric bearings, expansion joints

Reference books:

1. Dr. V.K. Raina, "Concrete Bridge Practice", Tata McGraw Hill.
2. Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "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. Krishnaraju N., "Advanced reinforced concrete design", CBS Publication and Distributors, 2000, 1st Edition.
5. Rowe R. E., "Concrete Bridge Design" John Wiley and Sons, 1963, 1st Edition.
6. Victor D. Johnsan, "Essential of Bridge Engineering", Oxford and IBH Publishing Co., Pvt. Ltd.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

CE 453 EXPERIMENTAL STRESS ANALYSIS

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Unit 1 **8 hrs**

Introduction to experimental stress analysis, advantages of ESA technique, Fundamental concept of strain measurement.

Development of ERSG, types, construction and material, Gauge sensitivity and gauge factor, transverse sensitivity, correction for transverse strain effect, Grid, Backing material, Adhesive, Mounting method, checking gauge installation, Performance characteristics of foil strain gauge, linearity, hysteresis, zero shift, environmental effect, moisture proofing.

Unit 2 **5 hrs**

Wheatstone bridge circuit, sensitivity, types, balancing of bridges, constant current circuit, Transducer application, diaphragm pressure transducer, displacement transducer, axial force transducer, bending force transducer, torque transducer.

Unit 3 **7 hrs**

Introduction, determination of principal strains, principal stresses, maximum shear stress and principal angles, three and four element rectangular rosette, delta rosette, tee rosette.

Introduction, general principles, advantages and disadvantages, state of stress and laws of failure, detection of cracks, types of brittle coating, test procedure, calibration technique.

Unit 4 **7 hrs**

Basic optics related to photo elasticity, ordinary light, monochromatic light, polarized light, natural and artificial

Unit 5 **5 hrs**

Birefringence, Stress optic law in two dimensions at normal incidence, Material fringe value in terms of stress function

Unit **7 hrs**

Plane polariscope, isoclinics, isochromatics, Circular polariscope, different arrangements, isochromatics, Fractional fringe measurement, Tardy's method , Babinet Soleil method, Selection and properties of model materials, Calibration methods, circular disc, tensile specimen, Separation methods, oblique incidence method, shear difference method

Reference books :

1. Dailly and Riley, “Experimental stress analysis”, McGraw Hill
2. Direlli, “Applied stress analysis”
3. Dr. Sadhu Singh, “Experimental stress analysis”, Khanna Publications
4. Frecht, “Photoelasticity”, Vol. I
5. Holister Dove and Adams, “Experimental stress analysis”
6. Perry Listner, “The strain gauge primer”

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

CE 454 TRANSPORTATION INFRASTRUCTURE PLANNING and DEMAND ESTIMATION

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Unit 1 **7 hrs**

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 toTransportation 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 – Feasibility Studies, Detailed Studies (Detailed Project Reports).

Unit 2 **6 hrs**

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.

Unit 3 **6 hrs**

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.

Unit 4 **5 hrs**

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.

Unit 5 **10 hrs**

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.

Unit 6 **6 hrs**

Intelligent Transport System: Technology oriented systems area –Advanced traffic management system, traveller 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.

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 of Public 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. and N.B. Lal, "Principles and Practice of Highway Engineering (Including Expressways and Airport Engineering)", Khanna Publishers, New Delhi. (2004)
7. Kadiyali L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi. (1994)
8. McShane W.R. and Roess R.P., "Traffic Engineering", Prentice-Hall Inc., New Jersey(1990)
9. Partha Chakroborty and Animesh Das, "Principles of Transportation Engineering, Prentice-Hall India, New Delhi. (2003)
10. Pignataro L.J., "Traffic Engineering: Theory and Practice", Prentice-Hall Inc., New Jersey. (1973)
11. Putman S.H., "Integrated Urban Models", Pion Ltd., London. (1983)
12. Wilson A.G., "Entropy in Urban and Regional Modelling", Pion Ltd., London(1970):
13. Wells G.R., "Traffic Engineering – An Introduction", Griffins, London. (1970):
14. Wohl M. and Martin B.V., "Traffic System Analysis of Engineers and Planners", McGraw-Hill Book Co., New York.
15. www.nhai.org

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

CE 455 PAVEMENT ANALYSIS, DESIGN AND EVALUATION

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Unit 1 **9 hrs**

Stresses and Deflections in Flexible Pavements: Types and component parts of pavements, Factors affecting design and performance of pavements. Comparison of highway and airfield pavements. Stresses and deflections in homogeneous masses. Burmister's two layer theory, three layer and multi layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads.

Flexible Pavement Design Methods for Highways: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages and application of the different pavement design methods including IRC: 37-2001.

Unit 2 **9 hrs**

Stresses in Rigid Pavements: Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

Design of Rigid Pavements: Design of CC pavement for roadway, Types of joints in cement concrete pavements and their functions, joint spacing; design of joint details for longitudinal joints, contraction joints and expansion joints. IRC:58-2002 method of design, Design of continuously reinforced concrete pavements.

Unit 3 **4 hrs**

Pavement Maintenance Management: Pavement failures: Failures in flexible pavement and rigid pavement; Methods of Maintenance of different types of pavements; Special problems in high rainfall areas and wet/water logging condition, maintenance of drainage system, Components of Pavement Management System, Examples of HDM/RTIM packages.

Unit 4 **7 hrs**

Pavement Evaluation: Visual rating, Pavement Serviceability Index, Roughness, Skid resistance and Deflection measurements, Use of modern equipment for pavement surface condition measurements-

Analysis of data, interpretation and application, Functional evaluation, Structural evaluation of flexible pavements by rebound deflection method, analysis of data, interpretation and applications, FEM, and Benkelman Beam Deflection Technique (IRC:81-1997),

Choice and Design of overlay type and pavement materials over existing flexible and rigid pavements with different degrees of distress. Rehabilitation and Recycling of bituminous pavement.

Unit 5 **4 hrs**

Structural Design of Airfield Pavements: Design Factors, Basic Runway Length, Correction for Elevation, Temperature and Gradient, Runway Geometric design, Design Methods for Airfield

Flexible Pavements: CBR Method, McLeod method, Burmister's method, Analytical and Computer aided design, Design Methods for Airfield Rigid Pavements, LCN System of Pavement design, Design of Joints in Cement Concrete Pavements.

Unit 6 **6 hrs**

Drainage: Design and construction of surface and sub-surface drainage system for highways and airports. Drainage materials, design procedures and IRC Guidelines for Drainage of Urban Roads.

Reference books :

1. Horonjeff Robert., "The Planning and Design of Airports,", McGraw-Hill Book Co., New York.
2. IRC: 76-1979 – Tentative Guidelines for Structural Strength Evaluation of Rigid Airfield Pavement, IRC, New Delhi.
3. IRC: 85-1983 – Code of Practice for Accelerated Strength Testing and Evaluation of Concrete Road and Air field Constructions, IRC, New Delhi.
4. IRC: 58-2002 (Second Revision) – Guidelines for the Design of Rigid Pavements for Highways, IRC, New Delhi.
5. IRC: 37-2001 – Guidelines for the Design of Flexible Pavements for Highways, IRC, New Delhi.
6. Kadiyali L.R. and N.B. Lal, "Principles and Practice of Highway Engineering (Including Expressways and Airport Engineering)", Khanna Publishers, New Delhi. (2004)
7. Khanna S.K. and C.E.G. Justo, "Highway Engineering", Nem Chand and Bros., Roorkee
8. Khanna S.K., Arora M.G. and Jain S.S., "Airport Planning and Design, Nem Chand and Bros., Roorkee
9. Partha Chakroborty and Das Animesh, "Principles of Transportation Engineering", Prentice-Hall India, New Delhi.
10. Yang H. Huang, "Pavement Analysis and Design", Prentice- Hall 1993
11. Yoder E.J. and Witczak M.W. "Principles of PavementmDesign", John Wiley and Sons, Inc., New York. 1975

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

CE 456 HYDROLOGY AND WATERSHED MANAGEMENT

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Unit 1 **7 hrs**

Runoff and River Gauging

Estimation of Runoff by Curve Number Method, Rational Method and using Empirical formulas, Stage – Discharge Measurement, Runoff Simulation Models (HEC)

Unit 2 **10 hrs**

Design Flood

Definition and causes of Floods, Design Flood and its Importance, Estimation of Design Flood in Gauged and Ungauged Catchments,

Flood Frequency Analysis, Rainfall Intensity-Duration and Frequency Relationships

Unit 3

Flood Routing

Inflow-Outflow Relationship, Hydrologic Channel Routing, Hydrologic Reservoir Routing, Flood Routing Machines, Flood Forecasting, Flood Control Measures

Unit 4 **8 hrs**

Soil Erosion and Conservation

Soil erosion Agents, Types of soil erosion due to water, Estimation of Soil Erosion by Soil Loss Models, Sediment Outflow Models, Bed Load Models and Sedimentation Models of water storage structures

Soil Conservation Practices Erosion Control Structures for Agricultural and Nonagricultural Lands (viz. Contouring, Bunds Terraces, Gully Control Structures etc.)

Unit 5 **8 hrs**

Water Harvesting

Watershed: Concept and Characteristics, Elements of Watershed Management, Watershed Models, Water Conservation / Harvesting Measures through Appropriate Technology viz. Contour Methods,

Check Dams, Ponds, Rooftop Rainwater Harvesting etc. Integrated Water Resources management, Conjunctive Use, Groundwater Recharge, Application of Remote Sensing and GIS

Unit 6 **6 hrs**

River Basin Management

Types of Rivers and their characteristics, Indian rivers and their classification, Behavior of Rivers, River Regime theory, Meandering, Control and Training of Rivers

River Basin Systems, Actions Causing Disturbance in Stream System and Their Impacts, Environmental Effects of Hydraulic Structures, Water Quality in Reservoirs, Stream Pollution, River Action Plans, Stream Restoration

Reference books :

1. Garde R.J., "River Morphology", New Age International Pubishers
2. Ghashyam Das, "Hydrology and Soil Conservation Engineering", Prentice-Hall India
3. Gurmel Singh, VenkatRaman G.Sastry, B.P.Joshi, "Manual of Soil and Water Conservation Practices", Oxford and IBH
4. Murthy J.V.S., "Watershed management", New Age International Pubishers
5. Raghunath H.M., "Hydrology- Principles, Analysis, Design", Wiley Eastern Limited
6. Sharma R.K. and Sharma T.K., "Irrigation Engineering (Including Hydrology)", S.Chand
7. Wurbs Ralph A. and Wesley P., "James Water Resources Engineering, Prentice-Hall India

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

CE 457 WATER POWER ENGINEERING

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Unit 1 **4 hrs**

Introduction: Sources of energy, types of power station, choice of type of generation, component parts of water project, types of hydro power schemes, general layouts of hydropower schemes.

Unit 2 **7 hrs**

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

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

Unit 3 **9hrs**

Intake, types, level of intake hydraulics of intake, trash rack transition from gate to conduit intake gates. (vertical list and taint, general discussion only)

Conduits : Types, economic section, power canals, pen-stock types hydraulic design and economic diameter pipe supports, anchor blocks, tunnels – classification, location and hydraulic design, tunnel linings.

Unit 4 **7 hrs**

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

Power station general arrangements of power station, power house, sub-structure and super structure, main dimensions underground power station – necessity principal, types, development and economics.

Unit 5 **7 hrs**

Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitation.

Tail race: Functions, types, channel and tunnel draft tubes, function and principal types.

Unit 6 **5 hrs**

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

Tidal power stations: Classification according to the principle of operation and general description of different types, depression
power plants.

Reference books :

1. Bhattacharya P. K., "Water Power Engineering", Khanna Pub., Delhi
2. Brown G., "Hydro-electric Engineering Practice" – Vol. I, II and III
3. Creager and Justin, " Hydro – Electric Hand Book"
4. Dandekar M. M., "Water Power Engineering", –Vikas Pub. House Pvt. Ltd
5. Deshmukh M. M., "Water Power Engineering", Dhanpat Rai and Sons
6. Mosonvi E., "Water Power Development" – Vol. I and II
7. Varshnaya, "Hydro Power Structures"

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

CE 458 OPEN CHANNEL HYDRAULICS

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Unit 1 **5 hrs**

Basic Fluid Flow Concepts: Classification of open channels and O.C.F., Basic equations (Continuity, Energy, Momentum) , Energy and Momentum coefficients, Specific energy and Critical depth, Establishment of Uniform flow in open channels, Uniform flow formulae, Section factor and conveyance factor, First and Second hydraulic exponent , Uniform flow computations

Unit 2 **10 hrs**

Non-Uniform Flow in Open Channel: Types of Non-Uniform flow, Governing equation for GVF, Characteristics and classification of surface curves, Computation of GVF in prismatic channels,

Hydraulic jump in rectangular channels (Types and characteristics), Jump on sloping floor, Jump in non-rectangular channels ,Use of jump as Energy Dissipater, Spatially-Varid Flow, Side weir, Bottom racks

Flow in Non-linear alignment Channels: Nature of Flow, Spiral Flow, Energy Loss, Superelevation, Cross Waves, Design Considerations for Subcritical flow, Design Considerations for

Supercritical flow

Unit 3 **9 hrs**

Flow Through Non-prismatic Channel Sections: Transitions and contractions in open channel flow, Subcritical flow through sudden transitions and constrictions, Contractions and Expansions in

Supercritical flow, Standing wave flume, Flow between bridge piers, Flow through culvert, Flow through Trash Racks.

Unsteady Flow in Open Channels: Gradually Varid Unsteady Flow, Waves and their classification, Celerity of a wave, Rapidly Varid Flow, Surges, Positive and negative Surges, Surges in Power Canals,

Dam-break problem

Unit 4 **5 hrs**

Dispersion in Open Channels: Diffusion and dispersion, Governing equations, Some classical solutions of the diffusion equation, Dispersion and diffusion coefficients, Discharge measurement using tracer techniques, discharge of hot water into rivers

Unit 5 **5 hrs**

Hydraulics of Mobile Bed Channels: Initiation of motion of sediment, Bed forms, Sediment Load, Method of permissible velocity and Critical Tractive Force Approach to design Erodible Channels, Regime Theory for Alluvial Channels

Unit 6 **5 hrs**

Hydraulic Models: Fixed bed river models (Distorted and Undistorted), Moveable bed Models, Model materials and construction, Physical model calibration and verification, Special-Purpose models

Reference books :

1. Chow Ven Te, "Open Channel Hydraulics", McGraw-Hill International Editions
2. Chaudhary M. Hanif, "Open-Channel Flow", Prentice-Hall International Publications
3. Richard H. French, "Open Channel Hydraulics", McGraw-Hill International Student Edition
4. RangaRaju K. G., "Flow Through Open Channels", Tata Mc Graw Hill Publsh. Co. Ltd.

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

ELECTIVE I, ELECTIVE II AND ELECTIVE III

CE 459 ANALYSIS AND DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Unit 1 **6 hrs**

Dynamics of MDOF systems subjected to Earthquake loading

Concept of MDOF systems, equations of motion, free-vibrations, Eigen-value analysis, frequencies and mode-shapes, orthogonality of modes, proportional damping, rayleigh damping, modal analysis for earthquake loading, participation factors, modal mass participation

Unit 2 **7 hrs**

Response spectrum analysis of MDOF systems.

Concept of response spectrum analysis as applied to MDOF systems, modal combination rules, SRSS and CQC methods, response spectrum analysis using IS:1893, analysis of asymmetrical buildings, torsional response, accidental eccentricity.

Unit 3 **7 hrs**

Analysis of framed buildings using approximate methods.

Portal and cantilever methods of analysis for lateral loading, substitute frame methods for vertical loading, determination of design forces using load combinations of IS:1893.

Unit 4 **4 hrs**

Geotechnical Earthquake Engineering.

Dynamic soil properties, laboratory and field tests, liquefaction and its effects, dynamic modeling of soil, soil-structure interaction.

Unit 5 **10 hrs**

Earthquake Resistant Design of Reinforced Concrete members.

Earthquake resistant design philosophy, Design and detailing of RC members, flexural members, compression members, shear walls, provisions of IS:13920.

Earthquake Resistant Design of Masonry structures.

Behavior of unreinforced and reinforced masonry walls, box-action and bands, behavior of infill walls in a frame, provisions of IS:4326, seismic design of masonry buildings, restoration and strengthening of masonry walls.

Unit : 7 **5 hrs**

Modern approaches for Earthquake Resistant Design.

Concepts of active and passive vibration control, Passive control devices, base-isolation concept and systems, tuned-mass damper, viscous dampers, metallic dampers, visco-elastic dampers.

Reference books :

1. Chopra A.K., "Dynamics of Structures-Theory and Applications to Earthquake Engineering", Prentice Hall Publications.
2. Clough and Penziene, "Dynamics of Structures", Mc-Graw Hill Publications.
3. Duggal S.K., "Earthquake Resistant Design of Structures", Oxford University Press.
4. Dowrick D.J., "Earthquake Resistant Design", John Wiley Publications.
5. Englekirk Robert E., "Seismic Design of Reinforced and Precast Concrete Buildings", John Wiley Publications.
6. Farzad Naeim – Kluwer, "The Seismic Design Handbook", Academic Publishers.
7. Kelly James M., "Earthquake Resistant Design using Rubber", Springer
8. Kramer Steven L., "Geotechnical Earthquake Engineering", Pearson Education.
9. Soong T.T. and Dargush G.F., "Passive Energy Dissipation Systems in Structural Engineering"

OPEN ELECTIVE (Interdisciplinary)

It is an interdisciplinary subject. Syllabus will be decided by concerned faculty. It will be offered for a batch of minimum students.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 460 ADVANCED ENVIRONMENTAL ENGINEERING

Laboratory

A. Six Assignments based on following topics

1. Meteorological Aspects
2. Sampling and Analysis
3. a) Chemistry of air pollution,
   b) Effects of Air Pollution,
   c) Odors
4. a) Control of Pollution,
   b) Land use planning,
   c) Air Pollution Control by Legislation and regulation
5. a) Economics of air pollution control
   b) Environmental Impact Assessment
6. a) Vehicular Pollution
   b) Noise Pollution

B. A visit to an Industry to study Air pollution monitoring, control Equipments etc.

C. A seminar on any of the topic

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 461 SYSTEMS APPROACH IN CIVIL ENGINEERING

The laboratory work shall consist of minimum twenty assignments on the following:

A) Assignments

1. Simplex Method
2. Two Phase Method
3. Method of Big-M
4. Sensitivity or Post Optimality Analysis
5. Primal Dual Relations
6. Allocation Problem
7. Transportation Problems
8. Assignment Problems
9. Queuing Theory
10. Simulation
11. Sequencing
12. Dynamic Programming
13. Dichotomous Method
14. Fibonacci Method
15. Golden Section Method
16. Gradient Techniques
17. Steepest Ascent/Descent Technique
18. Newton‟s Method
19. Quasi-Newton‟s Method
20. Secant Method
21. Lagrangian Multiplier Technique
22. Kuhn-Tuckers Conditions
23. Penalty Function Methods
24. Benefit Cost Analysis
25. Games Theory and its Application to Construction Management
26. Replacement Models

B) Computer Based Solution

Three Assignments would be carried out with the help of available computer programmes

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 462 MATRIX ANALYSIS OF STRUCTURES

Laboratory

The Laboratory work shall consist of following:

1. One Assignment on Basic Concepts
2. Two Assignments on Stiffness Analysis of Plane Truss and Beams
3. Four Assignments on Stiffness Analysis of plane frame, space trusses, space frames and grids
4. Use of computer programs (MATLAB, SCILAB, etc.) to carryout stiffness analysis of structure

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 463 REMOTE SENSING AND GIS APPLICATION

Laboratory

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

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 464 HUMAN RESOURCE MANAGEMENT IN CONSTRUCTION

Laboratory

The laboratory work shall consist of following:

A. Six Assignments based on following topics

i. HRM and HRD
ii. Human Resource Planning
iii. Personnel Management
iv. Human resources
v. Training
vi. Motivation Perspective

B. A seminar on any of the topic

C. Case study on HRM by every individual student

Case study will be submitted in report and a presentation will be done on it. CD of the report and presentation will be submitted by the student to the concerned faculty and will be graded accordingly.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 465 ADVANCED ANALYSIS OF STRUCTURES

Laboratory

The laboratory work shall consist of following:

1) One Assignment on Basic Concepts

2) Two Assignments on analytical solution of rectangular plates

3) One Assignment on Approximate Method

4) One Assignment on Numerical Method

4) Three assignments on structural dynamics problems

5) Computer Program for Navier solution of rectangular plates

6) Computer program for forced vibration response of SDOF system

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 466 ADVANCED DESIGN OF STRUCTURES

Laboratory

i. Design Assignments on following topics:
ii. Design and detailing of Deep Beams
iii. Design of Ribbed (voided) Slab and Grid Floors
iv. Design of Flat Slabs.
v. Design of Shear Walls.
vi. Intel Tanks
vii. Design of Cast-in-Situ Beam-Column Joints

Detailing to be done, as per codal provisions and drawn on A4 sheets.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 467 PLUMBING SERVICES

Laboratory

The laboratory work shall consist of the assignments based on the following topics:

1. Draw toilet layouts, plans, elevations and sections of a selected case for study with dimensions.
2. Prepare layout of internal and external (outside the toilet) SWRV pipes and fittings of a selected case for study with pipe diameters.

Topic Presentation:

Based on the topics covered in the semester, students can select any topic; refer to codes, text books, professional magazines, technical papers published and websites of manufacturers and make a presentation in 10 minutes.

Students can work in a group of two. Marks are assigned for both, the contents as well as presentation.

Prepare layout of internal and external hot and cold water supply system including controls, for a selected case for study.

Draw layout of external development comprising storm drainage, underground sewer and cold water supply, for a selected case for study.

Visit any plumbing site and submit a report on observations and recommendations based on the provisions of UPC-I.

Note:

A Laboratory Record based on the laboratory work would be submitted for the laboratory work.

Oral Examination would be based on the laboratory work and theory covered in the class under the subject Plumbing Services.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 468 ADVANCED ENGINEERING GEOLOGY AND ROCK MECHANICS

Laboratory

LIST OF EXPERIMENTS

1. Logging of drill core, preparation of lithologs and interpreting drilling data.
   Calculation of R.Q.D. and joint frequency index.
   Preparing geological crosssections from drill hole data and using them for designing of civil engineering structures.
2. Use of electrical resistivity method for determining depth of bed rock
3. Study of geological aspects of an engineering projects and writing a report based on studies carried out during visits to the engineering project.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 469 ADVANCED GEOTECHNICAL ENGNIEERING

Laboratory

Teaching Scheme: Lectures: 2 hrs/week

A) Laboratory Experiments

1) Grain size analysis including Hydrometer or Pipette method

2) One dimensional consolidation test

3) Triaxial Test (Unconsolidated – Undrained Test) with pore water pressure measurement

4) Index properties of rock – density, porosity, unconfined compressive strength, water absorption

5) Tensile Strength Test of Geotextile

6) Soil – Geotextile Interface friction Test

B) Assignments

1) Design of retaining wall. (Analytical and Using Software)

2) Analysis of Stability of Slopes (Analytical and Using Software)

C) Report on Site Visit

A report based on visit to any construction project during the academic term with a specific intention of studying foundation details.

Note:

A Laboratory Record based on the laboratory work would be submitted for the journal.

Oral Examination would be based on the laboratory work and theory covered in the class under the subject Advanced Geotechnical Engineering. Course Teacher for the Laboratory would decide the breakup of Oral Examination. An Objective Multiple Choice Test may be conducted as a part of the Oral.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 470 WATER RESOURCES PLANNING AND MANAGEMENT

Laboratory

Teaching Scheme: Lectures: 2 hrs/week

The work shall consist of the assignments based on the following topics:

1. Estimation of reservoir capacity and yield by mass curve and sequent peak method
2. Estimation of crop water requirements
3. Preparation of working table for reservoirs
4. Flood routing methods
5. Reservoir sediment distribution by Empirical area reduction and Area
6. increment methods
7. Flow duration curve and Energy calculations
8. Regulation of reservoir for hydropower generation
9. Discounting Techniques
10. Use of optimization techniques

Note:

Oral Examination would be based on the laboratory work and theory covered in the class under the subject Water Resources Planning and Management.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 471 INTRODUCTION TO FINITE ELEMENT ANALYSIS

Laboratory

Teaching Scheme: Lectures: 2 Hrs. / week

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

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 472 ADVANCED FOUNDATION ENGINEERING LABORATORY

Work shall consist of the following

A) 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 well foundation
6. Design of sheet pile
7. Design of under reamed pile
8. Design of PVD

B) Site Visit

Course instructor would arrange two site visits as a part of Laboratory work. A report based on the site visit would form a part of the laboratory work.

Journal based on the assignments would be submitted for the term-work. Oral Examination would be based on the laboratory work and theory covered in the class under the subject Advanced Foundation Engineering. Course Teacher for the Laboratory would decide the breakup to Oral Examination. An Objective Multiple Choice Test will be conducted as a part of the Oral.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 473 FIBER REINFORCED CEMENT COMPOSITES

Laboratory

1. At least 10 practicals based on the following.
   Testing of constituent materials
   Testing of physical properties of fibers
   Properties of freshly mixed FRC
   Properties of hardened FRC
2. Brief report on two site visits.

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 474 ENERGY EFFICIENT AND COST EFFECTIVE BUILDING

Laboratory

A. Assignment on following:

i. Buildings and Environment
ii. Ferrocement, Ferro-concrete and Fibre reinforced composites
iii. Building blocks and Mortars for Masonry
iv. Introduction to design of load bearing structures
v. Alternative Roofing Systems and Masonry Domes and Vaults
vi. Concepts of Green Buildings

B. Energy Audit of existing building

C. Analysis and Design of Energy Efficient Building

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Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 475 ADVANCED WATER AND WASTE WATER MANAGEMENT

Laboratory

A.Experiments should consist of

Characterization of water and Waste water analysis

i. Physical
ii. Chemical
iii. Biological

B. Visit report of the following:

i. W.T.P.
ii. S.T.P.
iii. E.T.P.(Industrial)

C. Assignments/Solution of problems on B.O.D., reaction rate, Self-purification of streams.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 476 ADVANCED CONCRETE TECHNOLOGY

Laboratory

Experiments consists of

A. Designing the special concrete mix

i. Light weight concrete

ii. Fibre reinforced concrete

iii. Ferrocement

B. Non Destructive Testing

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 477 ENGINEERING OPTIMIZATION

Laboratory

Assignment based on following:

i. Linear Programming
ii. Nonlinear Programming
iii. Constrained Optimization Techniques
iv. Optimization in Structural design
v. Classical optimization techniques
vi. Geometric Programming

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 478 STRUCTURAL DYNAMICS

Laboratory

Assignment based on following units:

i. Three assignments based on Single Degree of Freedom Systems
ii. Multiple Degree of Freedom Systems
iii. Stodola- Vianello method
iv. Discrete systems
v. Distributed- parameter Systems
vi. Free and forced Vibration

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 479 REINFORCED SOIL AND ITS APPLICATION

Laboratory

(A) Experiments to be conducted (Any Three)

1) Plummet balance / Hydrometer Analysis.

2) Consolidation test.

3) Swelling Pressure Test.

4) Triaxial test with measurement of pore pressure.

(B) Assignments (Any Four)

1) Soil Classification.

2) Computation of Earth pressure behind Retaining Wall by Analytical method.

3) Computation of Earth pressure behind Retaining Wall by Graphical method.

4) Typical slope design with reinforced soil / Geosynthetics.

5) Design of machine foundation.

(C) Computer programme / Software package for solution of two topic covered in theory.

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 480 NUMERICAL METHODS

Laboratory

Experiments shall consist of at least 12 programs with flowcharts, source listing, input and outputs based on above topic in 'C' programming language on

Roots of Nonlinear Equations

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 481 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

Laboratory

Structural drafting and detailed drawings AutoCAD, AUTOLISP

Structural analysis and design by using STAAD.Pro, STRUD, ETABS, SAP, etc.

i. Steel structures

ii. Plane trusses, portal frames.

iii. R.C.C. structures

iv. Seismic Resistant design of RCC High rise Buildings

v. Wind load resistant design of Transmission towers, High rise Buildings steel buildings.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 482 DESIGN OF CONCRETE BRIDGES

Laboratory

A. 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

B. Design of any one type of bridge

C. Visit to bridge construction site

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

CEL 483 EXPERIMENTAL STRESS ANALYSIS

Teaching Scheme: P: 2hrs/week **Credit: 1**

Laboratory

Minimum **ten** of the following experiments to be performed

1. Study of electrical resistance strain gauge
2. Study of commercial strain indicator
3. Calibration of electrical resistance strain gauge. Determination of gauge factor Sg
4. Determination of unknown weight. Transducer application of strain gauge
5. Calculation of gauge factor and strain for single and two arm bridges.
6. Calculation of gauge factor and strain for four arms lateral and linear sensitive bridges.
7. Measurement by using commercial strain indicator and transducers.
8. Study of isoclinics and isochromatics and use of white light
9. Calibration of photo elastic model material. Determination of material fringe value.
10. Determination of fringe order by Tardy's method.
11. Separation of stresses by oblique incidence method.
12. Study of brittle coating method.

Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

CEL 484 TRANSPORTATION INFRASTRUCTURE PLANNING and DEMAND ESTIMATION

Teaching Scheme: P: 2hrs/week **Credit: 1**

Laboratory

A. Assignment on following:

i. Field studies on traffic volume at midblock, intersection;

ii. O-D studies;

iii. Speed studies, spot speed, speed and delay;

iv. Parking demand studies, accident studies.

B. Small project on traffic study of urban area

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

CEL 485 PAVEMENT ANALYSIS, DESIGN AND EVALUATION

Teaching Scheme: P: 2hrs/week **Credit: 1**

Laboratory

A. Assignments based on following topics:

i. Stresses and Deflections in Flexible Pavements
ii. Flexible Pavement Design Methods for Highways
iii. Stresses in Rigid Pavements
iv. Design of Rigid Pavements
v. Pavement Maintenance Management
vi. Pavement Evaluation
vii. Structural Design of Airfield Pavements
viii. Drainage

B. Design of Pavement

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

CEL 486 HYDROLOGY AND WATERSHED MANAGEMENT

Teaching Scheme: P: 2hrs/week **Credit: 1**

Laboratory

A. At least 2 assignments based on

i. Runoff and River Gauging
ii. Design Flood
iii. Flood Routing
iv. Soil Erosion and Conservation
v. Water Harvesting
vi. River Basin Management

B. Field visit to river-gauging site

C. Preparing Watershed Management Report

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

CEL 487 WATER POWER ENGINEERING

Teaching Scheme: P: 2hrs/week **Credit: 1**

Laboratory

A. At least 2 assignments based on each of the following:

i. Types of Hydro Power Schemes
ii. Nature of demand
iii. Conduits
iv. Surge Tank
v. Turbines
vi. Pumped storage plants
vii. Tidal power stations

B. Site visit to Water Power Engineering

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

CEL 488 OPEN CHANNEL HYDRAULICS

Teaching Scheme: P: 2hrs/week **Credit: 1**

Laboratory

A. At least 2 assignments based on each of the following :

i. Basic Fluid Flow Concepts
ii. Non-Uniform Flow in Open Channel
iii. Flow in Non-linear alignment Channels
iv. Flow Through Non-prismatic Channel Sections
v. Unsteady Flow in Open Channels
vi. Dispersion in Open Channels
vii. Hydraulics of Mobile Bed Channels
viii. Hydraulic Models

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Department of Technology

Final Year B. Tech (CIVIL ENGINEERING) (Semester VII and VIII)

CE ELECTIVE I, ELECTIVE II AND ELECTIVE III

Teaching Scheme: P: 2hrs/week **Credit: 1**

CEL 489 ANALYSIS AND DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

Laboratory

A. At least 2 assignments based on each of the following :

i. Dynamics of MDOF systems subjected to Earthquake loading
ii. Response spectrum analysis of MDOF systems
iii. Analysis of framed buildings using approximate methods
iv. Geotechnical Earthquake Engineering
v. Earthquake Resistant Design of Reinforced Concrete members
vi. Earthquake Resistant Design of Masonry structures
vii. Modern approaches for Earthquake Resistant Design

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Final Year B. Tech (CIVIL ENGINEERING) (Semester VIII)

AUDIT COURSE V

AC 427 CONSTITUTION OF INDIA

Teaching Scheme: P: 2hrs/week **No Credits**

UNIT 1 **4 hrs**

Preamble to the constitution of India. Fundamental rights under Part – III – details of Exercise of rights, Limitations and Important cases.

UNIT 2 **3 hrs**

Relevance of Directive principles of State Policy under Part – IV. Fundamental duties and their significance.

UNIT 3 **3 hrs**

Union Executive – President, Prime Minister, Parliament and the Supreme Court of India.

UNIT 4 **3 hrs**

State executive – Governors, Chief Minister, State Legislator and High Courts.

UNIT 5 **4 hrs**

Constitutional Provisions for Scheduled Castes and Tribes, Women and Children and Backward classes. Emergency Provisions.

UNIT 6 **3 hrs**

Electoral process, Amendment procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments.

Reference 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.
4. 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.
5. U.R.Gahai, "(1998) Indian Political System ", New Academic Publishing House, Jalaendhar.
6. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.
7. Yogendra Singh, "(1997) Social Stratification and Charge in India ", Manohar, New Delhi.