NOTIFICATION

No. 66/2022 Date : 18/06/2022

Subject : Implementation of new Syllabi of Semester VII & VIII of B.E.(Civil Engineering)(C.B.C.S.) as per A.I.C.T.E. Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester VII & VIII of B.E. (Civil Engineering) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2022-23 onwards as per ñ**Appendix – A**ò as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

ñ**Appendix A**ò

SYLLABUS OF B.E. SEM. VII & VIII (CIVIL ENGINEERING) [C.B.C.S.]

SEMESTER SEVENTH

7CE01: STRUCTURAL ANALYSIS – II

Learning Objectives of Subject:

- To understand the action and corresponding displacement in various type of structural elements.
- To learn about statically determinate and indeterminate structures.
- To analyze frames subjected to sway.
- To learn different analysis methods for analysis of beam and frames.
- To learn analysis of Plane truss, Space truss.

Course outcomes: At the end of the subject the students will be able -

- To decide what is required to be analyzed depending upon type of structural element.
- To know about degree of freedom, Condition of equilibrium and determinacy of element.
- To understand reason for failure and permissible limits for safety.
- To apply the knowledge of beam analysis for practical analysis and design purpose.
- To make application of various analysis methods for actual structural member analysis and design.

SECTION - A

Unit-I: 1. Moment distribution method, application to portal frames with sway. Multibay, multistoried, symmetrical frames subjected to symmetric loads only.

2. Slope deflection method: Application to portal frames with side sway.

Unit-II: 1. Kani's method: Continuous beams and single bay single storey portal frames with side sway.

2. Multi- bay, multi storeyed frames subjected to symmetric loads.

Unit-III: 1. Castigliano's second theorem, principle of least work, Analysis of redundant frames. (up to two degree redundancy).

2. Analysis of redundant trusses (up to second degree of redundancy).

SECTION – B

Unit-IV: 1. Muller - Breslau's principle, Influence line diagrams for continuous beams, upto two spanwith simple end supports.

2. Tension coefficient method & its applications to simple space trusses.

Unit-V: 1. Flexibility method, static redundancy, flexibility coefficients, compatibility condition application to beams.

Unit-VI: Stiffness method, kinematic redundancy, stiffness coefficients, direct stiffness approach, application to continuous beams and single - bay, single - storey portal frame.

Books Recommended:

1. Meghre A.S. and Deshmukh S.K., Matrix Methods of Structural Analysis, Charotar Publishing, Anand, India 2003.
2. Junnarkar, S. B., Mechanics of Structure, Volume I and II, Charotar Publishing House Pvt. Ltd., 2017
3. Jain and Arya, Theory and Analysis of Structures, Nem Chand & Bros.
4. Reddy. C. S., Basic Structural Analysis, Tata McGraw Hill
5. Norris and Wilbur, Elementary Structural Analysis
6. Bhavikatti, S. S, Structural Analysis Vol I and II, Vikas Publishing
7. Ramamrutham., S and Narayan R., Theory of Structures 9th Edition, Dhanpat Rai Books

7CE02: GEOTECHNICAL ENGINEERING – II

Learning Objectives of Subject:

- To learn the methods of exploration, objectives and its field application along with data interpretation.
- To understand the bearing capacity of shallow foundation.
- To study the earth pressure on retaining wall.
- To learn the pile foundation and well foundation.
- To understand the settlement evaluation of different types of foundation.
- To know the various ground improvement techniques.

Course Outcomes: At the end of the subject the students will be able ï

- To select the appropriate soil investigation method and get true sub soil parameters used for selection of type of foundation.
- To determine the bearing capacity of shallow foundation.
- To calculate the lateral earth pressure on retaining wall
- To find bearing capacity of well foundation and design of pile foundation.
- To evaluate the settlement of different types of foundation.
- To suggest the suitable method o ground improvement.

SECTION – A

Unit I: Exploratory Programme : Field exploration, objectives and methods of exploration planning of exploration programme soil boring , hand augers, percussion boring, rotary wash boring, collection of sample, split spoon sampler, disturbed and undisturbed samples and their criteria SPT test, field vane shear test, geophysical methods, electrical resistivity and soil refraction methods. Soil log bore presentation and interpretation exploration data.

Unit II : Bearing Capacity of Shallow foundation :- Concept of local and general shear failure, Different theories: Terzaghiôs Skemptonôs, Meyerhofôs, BIS method for bearing capacity , determination bearing capacity of granular soils based on SPT value. Concept of raft foundation and floating foundation. In situ methods of evaluation of bearing capacity, plate load test, static cone penetrometer, pressure meter test, contact pressure distribution diagram below the base of footing.

Unit III : Earth pressure: Earth pressure at rest, & plastic equilibrium of soil, Rankineôs and Coulombôs theory of active and passive earth pressure on retaining wall. Influence of surcharge, water table, Rebhannôs and Culmannôs simple graphical methods. Introduction to sheet pile and bulkhead and their classifications,(No design criteria) Cofferdam purpose, various types and their suitability.

SECTION – B

Unit IV : Pile foundation : Classification of piles and their uses, static analysis, formula for determination of pile capacity for driven and bored pile in sandy and in clayey soil , dynamic pile formula Negative skin friction, factors affecting it, piles in group and their capacity, group efficiency, factors affecting group efficiency, behavior of group of pile in sandy and in clayey soil, pile load test, effect of pile cap. Criteria for spacing and depth of piles. BISdesign criterion for undereamed Pile in clays and sands.

Unit V: Settlement Evaluation: Immediate, primary and secondary settlement for footing resting on homogenous isotropic, cohesive and cohesion less soils related to single footing, combined footing, & raft foundation etc., concept of differential settlement factors and causes for differential settlement, BIS requirement for total as well as differential settlement, service loads, proportioning of footing for uniform settlement, Computation of total and differential settlement of a single pile and group of piles in sandy and clayey soil.

Unit VI: Well foundation: Component & their function, sinking of well, types of force system, and their computation, design criteria for various components of wells, tilting and shifting Bearing capacity of well as per BIS.

Ground Improvement: Methods of soil stabilization use of admixture (lime, cement, fly ash) in stabilization) Mechanism of reinforced soil, use of Geo synthetics material and itôs function, vibroflotation, sand drain and preloading techniques.

Books Recommended:

1. C. Venkatramaiah, Geotechnical Engineering, New Age International publishers, 2012
2. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International Publishers, 2012.
3. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers, 2011
4. P.Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.
5. Alam Singh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
6. Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai

7. V. N. S. Murthy; Soil Mechanics & Foundation Engineering; CRS Press, Taylor & Francis Group, New York
8. Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
9. Joseph E. Bowles, Foundation analysis and design, Mcgraw-hill international book company, Inc., Singapore.
10. Ralph B. Peck, Walter E. Hanson, Thomas H. Thornburn , Foundation Engineering, 2nd Edition, ISBN-13: 978-0471675853, ISBN-10: 0471675857.

7CE03 : HYDRAULICS ENGINEERING

Course Objectives:

- To understand the flow pattern in the open channels.
- To understand the criteria for formation hydraulics jump.
- Study different types of GVF profiles and apply various methods to determine the length of GVF profiles.

Course Outcomes: Student shall be able to-

- Illustrate the flow pattern in the open channels, criteria for formation hydraulics jump.
- Identify different types of GVF profiles and methods.
- Compute of water hammer pressures in pipe.
- Design penstocks and surge tanks, understand causes of water hammer.

SECTION A

Unit I : Types of open channel flows, Computation of uniform flow, Chezys and Manningôs equation, most efficient rectangular and trapezoidal section, specific energy diagram, discharge diagram related problems.

Unit II : Theory of gradually varied flow, dynamic equation of GVF with proof ,Analysis of surface profile of gradually varied flow.

Unit III : Rapidly varied flow, Theory of Hydraulic jump, hydraulic jump in horizontal rectangular channel, elements of hydraulic jump, relation between conjugate depths.

SECTION B

Unit IV: Turbulent flow through pipes, Nikuradses experiments on artificially rough pipes, hydro dynamically smooth and rough pipes, Moodys diagram, velocity distribution laws.

Unit V :computation of water hammer pressure of frictionless flow in horizontal pipe for sudden and slow closer of valve, Application of Allieviôs method and charts, approximate pressure.

Unit VI : Function of surge tank and different type of surge tanks. Equation governing the flow inthe simple surge tank system. Analysis of flow in a simple surge tank system.

Text Books:

1 K. G. Ranga Raju, ñFlow through open Channelò, Wiley Eastern Limited(New Delhi), 2nd Edition, 1992.
2. VenTe Chow, ñOpen Channel hydraulicsò, Wiley Eastern Limited (New Delhi),13th Edition, 2009.
3. K. Subramanya, ñFlow in open Channelsò, Wiley Eastern Limited (New Delhi),3rd.
4. Modi P.N. & Seth S.M.: Hydraulics & Fluid Mechanics, SI Edition, Standard book house.

7CE04: ENVIRONMENTAL ENGINEERING – II

Course Objectives: -

- To learn the basics of sewage composition and its characteristics.
- To depict the information about various sewage treatment processes.
- To provide the adequate information on various disposal standards for industrial effluents.
- To study the information about air pollution and its effects.
- To understand the knowledge about solid waste generation and disposal methods.

Course Outcomes: -

- Define and explain the significance of terms and parameters frequently used in wastewater Treatment.
- Evaluate the influence of the different parameter in design and treatment of wastewater treatment plant (wastewater characteristics).
- Basic methodology for wastewater treatment (screening, grit chambers,sedimentation, biological treatment and chemical treatment)

- Appreciate the advantages, disadvantages and limitations of the technologies and new developments.
- An ability to identify and interpret the criteria for the classification of a substance as a solid/hazardous wastes.
- Ability to identify air pollution problems and interpret criteria air quality data.
- Evaluate the engineering solutions for industrial and vehicular air pollution problems.
- The candidate at the end of the experimental exercise would be able to perform field-oriented testing of wastewater.

SECTION –A

Unit-I : Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers design of sewers Laying out of circular sewers- Boning rod and sight rail method, Testing & maintenance of sewers.

Unit-II : Waste water characteristic, sampling of sewage, physical chemical and biological examinations, B.O.D. and C.O.D., B.O.D. equation, problems on B.O.D Pollution due to domestic and industrial waste. Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant. Preliminary Treatment:- Screening, Grit chamber, Detritus tank. Primary Treatment:- Sedimentation of sewage.

Unit-III : Biological treatment: Trickling filters, low rate & high rate tricking filters, construction details, Re-circulation Modification of trickling filters Activated sludge process - Process description, Methods of aeration, loading rates, Different modified forms of A.S.P.,MLSS& SVI, F/M.

SECTION –B

Unit-IV : Low cost waste treatments - Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Effluent standards for disposal on land, into stream and into sewers. MINAS. Self purification capacity of stream

Unit-V : Characteristics of solid waste:- Physical, chemical, biological analysis. Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins. Disposal of solid wastes:- Different methods, sanitary land fill, composting, incineration.

Unit-VI :Air pollution: Introduction to air pollution, various pollutants their sources and their effects on man and material, prevention or air pollution at sources, introduction to control devices electrostatic precipitator & cyclones only human tolerance level Introduction to EIA and Environmental Audit.

Books Recommended:

1) Kshirsagar S.R. : Sewerage and Sewage Treatment, Roorkee Pub House, Roorkee.
2) Steel E.W. : Water Supply & Sewerage, McGraw Hill Book Co.
3) Birdie G.S. : Water Supply and Sanitary Engineering, Dhanpat Rai & Sonôs.
4) Garg S.K. : Waste Water Engineering, Khanna Publishers.
5) Dr. Bhide A.D., Sunderson B.B.: Solid Waste Management in Developing Countries, INSDC publication.
6) Rao M.N., Rao H.V.N. : Air Pollution, Tata McGraw Hill.
7) Stern, Wohlers, Boobel, Lowry: Fundamentals of Air Pollution, Academic Press, 1973.

7CE05 : (PROFESSIONAL ELECTIVE III)
(i) ANALYSIS AND DESIGN OF STRUCTURES FOR EARTHQUAKE AND WIND

Course Learning Objectives:

This course will cover the basics of seismology and Earthquake engineering. Students will learn

- Basic seismology, earthquake phenomenon and its characteristic.
- Earthquake resistant concept
- Use of earthquake bands in masonry structure
- Behavior of buildings during earthquakes
- Earthquake resistant design concept
- IS code procedure to find earthquake forces on structure
- Wind load Calculation for Multy-story Building

Course outcomes: At the end of the subject the students will be able to -

- Identify type of earthquake, its properties
- Do earthquake resistance planning
- Apply knowledge of seismic bands in masonry structure construction.
- To analyze and design buildings to resist seismic and wind forces
- Solve engineering problems in the context of Earthquake Engineering.

SECTION-A

Unit I: Interior of earth, Engineering geology of earthquakes, plate tectonics, Seismicity of the world, tectonics features of India, Faults, Propagation of earthquake waves, Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording), Determination of magnitude, Epicentre distance, focal depth, etc. Ground motion and their characteristics, Factors affecting ground motions, Inertia forces, horizontal & vertical shaking.

Unit-II: Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings, continuity of construction, projection & suspended parts, special construction features like separation of adjoining structure, stair case etc, twisting of building, seismic design philosophy for building.

Unit-III: Importance of flexible and ductile structures, Effect of earthquake on RCC Building, How Beam, Column & Beam Column joint resist earthquake, Effect of open ground story, Effect of short column, Use of shear wall, latest technique used to reduce earthquake effect on building (Base Isolation). Behaviour of R.C. building in past earthquakes.

SECTION-B

Unit-IV: Introduction to IS:1893 (2016),Concept of earthquake Resistant design, design philosophy. Design Horizontal Acceleration, Zone factor, Importance factor, Response Reduction Factor, Natural Time Period, Base Shear, Earthquake eccentricity, Earthquake load combination, Diaphragm, Centre of mass & rigidity, Seismic mass & weight, P-φ Effect, Calculation of nodal loads due to earthquake using Equivalent lateral force method.

Unit-V: Ductility and its important in earthquake resistant design, Factors affecting ductility, Ductile detailing considerations as per IS:13920 (2016) for flexural member, axial member and joints of frame. Earthquake resistant design of RCC Columns, beams.

Unit-VI: Wind load Calculation for Multy-story Building as per IS 875-Part-3 : 2015.

[Note: Students should use IS 1893:2016, IS 13920:2016, IS 875-Part-3: 2015.]

Books Recommended:

1. Duggal S.K. Earthquake Resistant Design of Structures , Oxford University Press
2. Pankaj Agrawal, Manish Shrikhande Earthquake resistant design of Structures, Prentice Hall India

7CE05 : PROFESSIONAL ELECTIVE III
(ii) ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE

Course Objectives:

The course aims to introduce the concepts, procedures and methodology of Environmental Impact Assessment (EIA) in order to develop a critical awareness of factors that will be helpful in the use of EIA as part of project management in the legislative and regulatory context of recently-industrialized or less -industrialized countries that would eventually expose the students to the need for environmental impact assessments and would be help them in the preparation of various documents required for legal procedures.

Course Objectives: At the end of the course the student will :

1. Understand the concept and basic process of environmental impact assessment.
2. Have knowledge regarding Impact assessment methodologies and Components of EIA.
3. Be able to perform environmental auditing.
4. Have knowledge regarding Sustainable development & environmental management.

SECTION A

Unit I: Environmental impact assessment (EIA): Definition of EIA and EIS, Concepts, scope and objectives of EIA; National Environmental Policy Act (NEPA, 1969); EIA guidelines1994 (Notification of Government of India).Screening and Scoping in EIA.

Unit II: Impact assessment methodologies: Definition and concept of impact; Types of impacts (Negative & Positive: Primary & Secondary; Reversible and Irreversible); Impact identification; Methods for impact identification: Matrices, networks and checklists, Advantage & disadvantages of EIA methodologies.

Unit III: Components of EIA: Baseline data; Prediction and evaluation of impacts; Environmental management plan and monitoring, Baseline information, Prediction, evaluation and mitigation of impacts on socioeconomic, air water, soil and noise environment.

Public participation in EIA: Decision making, public participation in environmental decision making, Objectives and techniques for public participation, Advantages and disadvantages of public participation.

SECTION B

Unit IV: Preparation and writing of EIA: For water resources, Dams and irrigation projects; Mining and Infrastructural projects etc., eco ï labelling eco-marks, ecotourism, eco-feminism, Eco-regulation, eco-accountability, green management, green products, green claims, and eco wars.

Unit V: Environmental auditing: Notification and guidelines for Environmental audit; Scope, applicability and objective of environmental audit; procedure of environmental auditing ;Cost Benefit analysis, Designing and implementation of audit tools

Pre audit activities ï on site activities ï post audit activities ï Environmental statement ï benefits of environmental audit ï EA scenario in India ï submission of Environmental Audit report in MoEF format .Life cycle Assessment, Resource Balance, Energy Balance and Management Review.

Unit VI: Sustainable development & environmental management, Natural Resource Conservation, Conservation of Energy, Pollution Prevention, disposal of treated effluents and solid waste, Environmental Management in India.

Books Recommended:

1. Environment Impact Assessment: Larry W. Canter, Mc-Graw Hill Inc., New York (1996).
2. Introduction of Environmental Impact Assessment: John Glassion, Rikay Therival and A. Chadwick, UGC Press Ltd., London (1994).
3. Methods of Environmental Impact Assessment: Peter Morris, Ricky Therivel, UGC Press Limited, London (1994).
4. Environmental Impact assessment: N.S.Raman, A.R.Gajbhiye, Dreamtech publication.

7CE05 (PROFESSIONAL ELECTIVE - III)
(iii) PAVEMENT DESIGN

Learning Objectives of Subject:

- To understand types of pavement for highway & airport.
- Perform analysis of flexible pavement by various methods.
- Perform design of flexible pavement by various methods.
- Perform analysis of rigid pavement by various methods.
- Perform design of rigid pavement by various methods.
- To understand design, maintenance, repair & rehabilitation of pavement as per
- IRC standards.

Course outcomes: At the end of the subject the students will be able ï

- To explain basics of highway & airport pavement.
- To carry out analysis of flexible pavement by various methods.
- To carry out design of flexible pavement by various methods.
- To carry out analysis of rigid pavement by various methods.
- To carry out design of rigid pavement by various methods.
- To apply IRC design parameters in design, maintenance, repair & rehabilitation
- for different types of pavement.

SECTION A

Unit I: Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. Stresses and deflection in flexible pavements.

Unit II: 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. Pavement behaviour under transient traffic loads.

Unit III: Flexible Pavement Design Methods For Highways and Airports: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC;

SECTION B

Unit IV: 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.

Unit V: Rigid Pavement Design: Types of joints in cement concrete pavements and their functions, joint spacing; design of CC pavement for roads and runways as per IRC, design of joint details for longitudinal joints, contraction joints and expansion joints.

Unit VI: IRC method of design by stress ratio method. Design of continuously reinforced concrete pavements; Maintenance, repair and rehabilitation of pavements including design of bituminous and concrete overlays as per IRC.

7CE05 : (PROFESSIONAL ELECTIVE - III)
(iv) WATER POWER ENGINEERING

Course Objectives:
1. To understand necessity and importance of sources of energy
2. To learn about different types of hydropower plants
3. To study various power canals and design of power canal structures

Course Outcome: Student shall be able to:
1. Describe the various sources of energy systems.
2. Classify the different power plants.
3. Identify the problems related to hydraulic pressure.

SECTION A

Unit I: Water Power: Introduction, sources of energy, importance of water power, estimation of water power potential, primary and secondary power, load factor, pondage and pondagefactor, load curve, numericals. Type of hydropower plants:- low and high head, run of river, valley dam, diversion canal, high head diversion, pumped storage underground, general description, layout, topographical requirements of each of above.

Unit-II: Penstocks: general classification, design criteria, economical dia, anchorages and accessories. Water hammer: - meaning, rigid and elastic water column theory, Allievi's charts, numerical.

Unit-III: Surge tanks: Necessity, types, function, location, effect of sudden load change, Hydraulic design of simple surge tanks, stability of surge tanks, numerical.

SECTION – B

Unit-IV: Intakes: types, locations, requirements, trashrack and other components, control gates, emergency gates, Air Entrainment.

Unit-V: Hydel Channel:- power canal and forebay, general principles of alignment and capacity, balancing tank. Turbines:-types, hydraulic features, size, general description of components and layout, specific speed, choice and selection of turbines, approximate costs, numericals on specific speed only.

Unit-VI : Power house:- types, general layout and approximate dimensions, advantages and disadvantages of underground power stations. Non-conventional sources of energy: - tidal power, wind power, geothermal power, solar power, elementary principles and description, application of water power in drilling and blasting of rocks. Note : Technical visit to nearby hydro power station is compulsory.

Books Recommended:
1) Dandekar M.M. &Sharma : Water Power Engineering, Vikas Pub. House, Delhi.
2) Brown J.G., Blackie and Practice : Hydro Electric Engg., Vol. I, II & III, W. Sons, London.
3) Mosonyi E. : Water Power Development, Hungarian Academic Sciences, Budapest.
4) Deshmukh M.M. : Water Power Engineering.
5) Davin C. and Sorenson K.C. : Hand Book of Applied Hydraulics, McGraw Hill.
6) Barrows H.K., Water Power Engineering, McGraw Hill.

7CE06 COMPUTATIONAL STRUCTURE ANALYSIS - LAB.

1) Analysis of simple structures (2D) like portal frames, Beams (1D) with different support conditions. Correlations of the same manually as well as by readymade software like STAAD Pro., SAP, ETABS, ANSYS etc.
2) Calculation of deflection and stresses in truss by using readymade software like STAAD Pro., SAP, ETABS, ANSYS etc.
3) Analysis and design of 3D (G+2) structure by using software like STAAD Pro., SAP, ETABS, ANSYS etc.

7CE07: GEOTECHNICAL ENGINEERING- II– LAB.

List Of Experiments: **(Any six)**
1. To determine the shear strength by conducting Field Vane shear test.
2. To identify the subsoil strata by conducting soil resistivity / seismic refractivity method
3. To determine the soil characteristics by conducting standard penetration test
4. To determine the bearing capacity of soil by conducting standard penetration test
5. To determine the soil properties by conducting the static cone penetration test.
6. Computation of bearing capacity by analytical approach to verify with field test.
7. To determine the soil characteristic with respect to soil log bore

Compulsory: Introduction to Geotechnical Software, determination of bearing capacity , earth pressure etc. professional this software.

7CE08 : ENVIRONMENTAL ENGINEERING II – LAB.

Minimum 8 practicals out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Field visit & report is compulsory.

List of Experiments:

1. Chemical Oxygen Demand (COD)
2. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)
3. Determination of Chloride concentration
4. Determination of Sulphate concentration
5. Colour measurement
6. Odour Measurement
7. Sludge volume index (SVI) determination
8. Physical characteristic of solid waste
9. Analysis of SPM by using sampler
10. Ambient noise measurement
11. Sketches on sewer appurtenances
12. Report of Field visit to Municipal wastewater treatment plant/Industrial effluent treatment plant.

SEMESTER VIII

8CE01: CONSTRUCTION PROJECT MANAGEMENT

Learning Objectives of Subject:

- Students should be able to understand meaning of project and Project Management .
- Students should be able to understand Project Life Cycle and Project Development Steps.
- Learner should know the process and various planning tools and their Limitation.
- Student should be able to carry out project planning using tools like BAR chart, Networking methods like CPM, PERT etc.
- Student should know the method of controlling using Baseline Plans and process of updating it.
- Student should know optimizing process of Project and way to carry out it by method of Network Crashing.
- Student should know process and need of Resource Smoothening / Leveling.
- Student should be able to develop planningôs using Project Planner software.
- Students should know the various management skills related to Quality, Safety and Inventory and Risk Handling.

Course outcomes: At the end of the subject the students will be able –

- To understand meaning of Project and Project Management.
- To understand the phases of Project Life Cycle and process of developing it.
- To use and apply various planning tools like BAR chart, Milestone Chart, Networking Methods like CPM , PERT .
- To compare and control the project at the time of execution.
- To update projects and review the status of work.
- To optimize project using Network crashing method
- To understand the concept of Project Smoothening/ leveling.
- To plan and develop the project using Project Planner softwareôs.
- To understand importance and application of various management like Quality , Safety , Risk handling and Inventory .
- To turn good manager at individual and organizational level.

SECTION – A

Unit I: Basic Element of Construction Management:
Stakeholders of Construction Project, Meaning of terms Project, Management and need of Construction Management. Life cycle of Project.
Learning of project elements like ï Activity & its types, Events, Work Breakdown Structure, Resources, Scheduling, and Resource Allocation.

Unit II: Planning Tools : Detail steps of planning, Concept, Limitation &**Numerical** over Planning Tool BAR CHART, MILESTONE CHART.
Introduction to Networking Development using Critical Path Method, Programme Evaluation & Review Technique, Concept of Line of Balance Method.

Unit III: Total Project Duration, Float/ Slack calculation ï Geometrical and Numbering Rules for Network Development.
Numerical to find out Total duration, critical path and Float/ Slack of a project by CPM & PERT method.

SECTION – B

Unit IV: Project Controlling: Concept and **numerical** over both Network Updating of Project and Project optimization by Network crashing method. Concept of Resource Smoothening / Leveling.

Unit V :- Project Review & Planning using Management software:
Importance of Documentation, Daily, Weekly, Monthly Progress report. Project Review process and documentation. Concept of Project associated Risk & Risk handling strategies.
Introduction to Illustration for project development using software like of MS Project and Primavera. Developing one small construction project using project planning software.

Unit VI- Organization & Management : Concept & Types of Organization, Feyolôs Principals of Management, Need and Concept of Quality Management, Safety Management, Inventory Management. Learning EOQ Analysis.

Text Book: Kumar NeerajJha, ñConstruction Project Management- Theory and Practiceò, Pearson Education, New Delhi ,17.

Reference Books:
1. K. K. Chitkara, ñConstruction Project Management- Planning, schedule and controllingò, second editionò, Tata McGraw Hill Education pvt. Ltd, New Delhi.
2. John M. Nicholas and Herman steven, ñProject management for engineers, business and technologyò, fourth edition, Routledge Publication, New York.
3. Prasanna Chandra, ñProjects Planning, analysis, selection, financing, implementation and reviewò, 7th edition, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. Harold Kerzner, ñProject Management system approach to planning, scheduling and controlling, second.

8 CE02: CONSTRUCTION ECONOMICS & ESTIMATING – COSTING

Learning Objectives of Subject:
- Student should be able to understand the concept of Estimation and construction Economics.
- Student should be able to understand and apply various estimation methods.
- Student should be able to understand need , concept and types of Specification.
- Student should be able to understand various cost estimation related terms and Rate Analysis.
- Student should be able to carry out Rate analysis of basic construction materials.
- Student should know the application of Current Schedule of Rate .
- Student should be able to carry out estimation of Residential and Commercial structures.
- Student should be able to carry out estimation of various road types like Rigid , Flexible and Hilly roads.
- Student should be able to understand concept , need and process of valuation of construction projects.
- Students should be able to understand and practice the Bidding and Tendering process.

Course outcomes: At the end of the subject the students will be able -
- Determine need and basics of Estimation and Construction Economics.
- Carry of estimation by various methods.
- Write and understand specification of materials and items of construction.
- Carry out rate analysis of basic construction material and apply calculation logic for other construction materials.
- Use of CSR for Estimation work and carry out estimation of residential , Commercial building, Flexible and Rigid Roads, Water Tank , Septic tank etc.
- Understand need, purpose and process of valuation .
- Understand and carry out Bidding and tendering process .

SECTION A

Unit I: Basics of Construction Economics & Estimations ï Concept of Construction Economics, Stakeholders of Construction Project, Need of Estimation , Units of Measurement as per IS1200 , various approximate and details method of Estimation. Specification ï Purpose and Principles of Specification Writing, Types of Specification Writing.

Unit II: Introduction to Schedule of rates in Cost estimates, Factors affecting analysis of rates, Fixed, Variable, Prime, Supplementary cost , Overhead cost and its allocation. Rate analysis concept and explanatory calculations of Some materials like Cement, Steel, Bricks, aggregates & Timber. Bar Bending Schedule ï Process of development.

Unit III: Current Schedule Rates (CSR) understanding & Utilization, Developing Cost & Quantity Estimates for ï the Residential block, Commercial building, House hold water tank, Septic tank, Staircase and Lift duct.

SECTION B

Unit IV: - Developing Cost & Quantity Estimates for ï Road works example for Rigid & Flexible Pavement. Earthwork Estimation in Hill roads and for earthen dams.

Unit V: - Valuation Purpose and types of Valuation, Market value, Potential value, Sentimental values , scrap Value etc. Tenure of Land, free hold and lease hold property, sinking fund, deprecation and capitalized value and annualized value of old building. Consideration of Building Life and Structural Stability Report at the time of valuation. Valuation validity period.

Unit VI: - Public organizations and various stake holders in construction Industry, Contract and its types, Detail process of Tendering & Bidding ï Concept of E Tendering, Tender Notice, Process of Filling the Tender, Process of Submission of Tender, Acceptance of tender, Tender Awarding. Land acquisition Act, Leal aspects of contract provision.

Books Recommended:

1. R.H. Namavati. : Estimating and Valuation.
2. D.N.Datta : Estimating & Costing ï Datta Lucknow.
3. Vazirani: C.E.Estimating & Costing, Chandola Khanna Publisher Delhi.
4. B.S.Patil: Estimating Costing ï Orient Longmans.
5. P.W. & H.Deptt. Govt. of Maharashtra: Standard Specification
6. Rangawala: Valuation, Charotar Book Stall
7. Dhanpat Rai: Text book of Estimates Costing ï Anand & Sons, Delhi.
8. B.C.Chakraborty: Principles of Estimation & Costing.
9. Indian Contract Act.

8CE03 : PROFESSIONAL ELECTIVE - IV
(i) ADVANCED DESIGN OF STEEL STRUCTURES

Learning Objectives of Subject:

- To introduce the concept of foot bridge.
- To understand the behavior of transmission tower.
- To understand the behavior of steel chimney
- To introduce the concept of truss bridge.
- To understand the behavior of plate girder.
- To understand the behavior of lattice girder and steel tanks.

Course outcomes: At the end of the subject the students will be able ï

- To explain the methods of design of foot bridge.
- To design transmission tower line.
- To design steel chimney and its foundation.
- To design the truss bridge.
- To design the plate girder.
- To design lattice girder and steel tanks.

SECTION – A
(By Limit State Method IS 800:2007)

Unit-I : (a) Design of foot bridge (N-Truss or Pratt)
(b) Analysis and design for transmission tower lines
Unit-II :(a) Design of self-supporting steel chimney and its foundation.
(b) Design of through type truss bridge member for dead load and equivalent live load including top, bottom bracings and open web girder bridges of Pratt trusses and portal bracing for railway broad gauge single main line.

SECTION – B

Unit-III : Design of Plate girder.
Unit-IV : a) Design of north light trusses and lattice girder.
b) Design of elevated, square pressed steel tanks and staging

Books Recommended:

1. Ramchandra, Design of Steel Structure, Volume - I and II. Scientific Publishers Journals Dept
2. Arya, Ajmani, Design of Steel Structures. Nem Chand
3. Duggal S. K., Limit State Design of Steel Structures ; McGraw Hill Education.
4. N. Subramanian, Steel Structures: Design and Practice: Theory and Practice; Oxford University Press, 2008

8CE03: PROFESSIONAL ELECTIVE - IV
(ii) ADVANCED PRESTRESS CONCRETE STRUCTURES

Learning Objectives of Subject:

1. To introduce the need for Prestressing as well as the methods
2. To introduce the general behavior of PC sections under external load.
3. To introduce the design of PC flexural members.
4. To introduce the design of shear in PC members.
5. To introduce the design for deflection and crack control of Prestress concrete members.

Course outcomes: At the end of the subject the students will be able ï

1. Explain the general behavior of PC sections under external load.
2. Explain behavior of Prestress concrete members and Losses in Prestress steel.
3. Analyze & Design of Prestress concrete flexural members.
4. Analyze & Design of Prestress concrete for shear
5. Analyze & Design of Prestress concrete Water Tank.

SECTION-A

Unit I: Introduction to Pre-stressed concrete: Pre-stress concrete concept, Materials and their characteristics as per IS code, Advantaged & Disadvantaged, Application, Differences of Pre-stressed concrete over Reinforced Concrete. Principle of Pre-stressing, Methods of Pre-stressing (Pre-Tension & Post-Tension), Tensioning Devices, Nature of concrete-Steel Interface (Bonded & Unbonded) various Pre-stressing systems. Losses of Pre-stress.

Unit-II: Analysis of Pre-stressed concrete beams for flexure, at different stages, under working load for Rectangular and flanged sections. Permissible stress at different stages as per IS 1343:2012 code.

SECTION-B

Unit-III: Introduction to Limit state Design (Serviceability & Collapse). Basic Design of rectangular sections for flexure by limit state method, Design of one way single span slabs.
Analysis and design of end block, anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams.

Unit-IV: Design of Pre-stressed concrete circular water tanks by IS code method. Analysis and design of Poles.

Note: 1) Students should use IS 456:2000, IS 1343:2012, IS 875 (Part III) : 2015.

Books Recommended:

1. Edward G. Nawy ñPrestressed Concrete- A fundamental Approachò, Prentice Hall**.**
2. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
3. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi**).**
4. P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH 5.

8CE03 : PROFESSIONAL ELECTIVE - IV
(iii) ADVANCED WATER TREATMENT

Course Objectives:

1. To educate the students on the principles and process designs of various treatment systems for water.
2. To impart knowledge about the advanced treatment for water.
3. Explain and design of various treatment process.
4. To use the fundamental principles of mass balance, chemical kinetics and equilibrium to design water reactors to achieve a desirable treatment goal.

Course Outcomes:

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

1. In-depth knowledge of physical chemical unit processes for advanced water treatment.
2. consider the application of this in research projects, and to contribute to the development of new theories and methods in the field.
3. Select or construct appropriate treatment schemes to remove certain pollutants present in water or waste water.
4. Developed conceptual schematics required for the treatment of water.
5. Translate pertinent forcing criteria into physical and chemical treatment system.
6. Provide recommendations of appropriate treatment processes for upgrading water and treatment efficiency

SECTION-A

Unit - I: water treatment facilities flow diagram, different unit operations and unit processes. Coordination of unit operations. Common attributes of water affected by conventional unit operations and processes. Aeration: rate of gas absorption and desorption, objectives of aeration, gravity aerators and spray aerators, design of aerators.

Unit-II: Coagulation& Flocculation: Coagulation Process ,concept of surface charge, coagulating effects of electrolytes, zeta potential, coagulants and coagulant aids, factors affecting coagulation. flocculation - Objectives of flocculation, mixing and stirring devices, flash mixing flocculators, construction and operation of flocculators, problems on design of flocculators.

Unit-III: Sedimentation: objectives, theory of sedimentation discrete settling and hindered settling, settling of flocculants suspension. Ideal settling basin and its efficiency. Design, construction and operation of sedimentation tanks. Inlet and outlet hydraulics, sludge, removal and disposal, tube and plate settlers. Problems on design of sedimentation tanks.

SECTION-B

Unit-IV: Filtration: Filtration Process, Principal Mechanisms of Filtration, Design of rapid and slow sand filters, filtering sand & their performance. Fluidization & bed expansion in backwashing, Under drainage systems with design, operation problem .Scour intensification, high rate, declined rate, upflow biflow, dual media, diatomaceous earth filters.

Unit-V: Disinfection: objectives, different disinfectants, chemical disinfection, theory, factors governing, and kinetics. Non Chemical Methods for Disinfection: Ozonation, UV radiation. Chemical Disinfection by chlorine, Types of Chlorination and other uses of chlorine, manageable variables.

Unit-VI: Miscellaneous methods of treatment : Water softening: lime soda and zeolite process, split treatment problems on calculation of dose of lime and soda ash. Iron and Manganese Removal : Fluoridation and Defluoridation. Theory & Methods of Desalination.

Books Recommended:

1) Fiar, Geyer &Okun : Water and Waste Water Engg., John Wiley & Sons.
2) Mark J. Hammer : Water and Waste Water Technology, John Wiley & Sons.
3) Steel E.W. & Ghee M.C. : Water Supply & Sewerage, McGraw Hill Co.
4) B.C.Punmia A.K.Jain: Water supply engineering, Laxmi publication.

8CE03 : PROFESSIONAL ELECTIVE - IV
(iv) Industrial Waste Water Treatment

Course Objectives:

1. Enrich the knowledge on sources and characteristics of industrial wastewater.
2. Discuss the different methods of waste water treatment such as de-nitrification, membrane separation, air stripping, etc.
3. Understand the characteristics and composition of wastewater generated from industrial processes.
4. Design and operate effluent treatment plants for joint treatment of raw industrial wastewater and domestic sewerage.
5. To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management.
6. Understand principles of various processes applicable to industrial wastewater treatment.
7. Identify the best applicable technologies for wastewater treatment from the perspective of yield production.

Course Outcomes:

On completion of the course, students will be able to:

1. Distinguish between the quality of domestic and industrial water requirements and Wastewater quantity generation.
2. Understand the industrial process, water utilization and waste water generation.
3. Acquire the knowledge on operational problems of common effluent treatment plants.
4. Impart knowledge on selection of treatment methods for industrial wastewater.
5. Specify design criteria for physical, chemical, and biological unit operations.
6. Define the Principles of pollution prevention and mechanism of oxidation processes.
7. Suggest the suitable technologies for the treatment of wastewater.
8. Discuss about the wastewater characteristics.
9. Design the treatment systems.

SECTION A

Unit I: Problem of Industrial Waste Water: Variation in quality and quantity of industrial wastewater. Effects of discharge of industrial waste water on streams; land and municipal sewers. Benefits of water pollution control by doing treatment of industrial waste.

Unit II: Indian Standards for discharge of treated wastewater on land, into municipal sewer and natural water courses. Sampling Procedure. Industrial waste survey; Stream sanitation, Stream sampling, Types of sampling, Stream survey, Sampling analysis.

Unit III: Approaches to Minimization of problem of industrial waste water, Good housekeeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal.

SECTION B

Unit IV: General Approach for handling and treatment of industrial wastewater with following special characteristics. Shock Loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Unit V: Process Line Diagrams, characteristics and treatment of industrial waste of: - Pulp and paper, textile, tannery, food, Cannings, sugar mill, distillery, dairy, pharmaceutical, electroplating etc. industries. Design of Effluent Treatment Plant.

Unit VI: Advanced industrial wastewater treatment: Principles of tertiary treatment, Reuse and resource recovery. Recent trends in industrial waste management, Cleaner technologies

Recommended Books:

1. Waste Water Treatment, Disposal and Reuse, Mctcalf and Eddy, Tata McGraw Hill Publishing Co.Ltd, 1995
2. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw-Hill, 1985.
3. Liquid Waste of Industry ï Theory, Practices and Treatment, Nemcrow, Addison- Wesley,1971.
4. Industrial Water Pollution Control, W.W. Eckenfelder, McGraw-Hill, 1989.M.Tech Environmental Engineering Curriculum w.e.f. Aug 2019 Page 28
5. Natural Systems for Waste Management and Treatment, S.C. Reed, E.J.
6. Middlebrooks and R.W. Crites, McGraw-Hill, 1988.
7. Biological Treatment of Waste Waters: W.W. Eckenfelder, Pergamon Press, 1961.

8CE03: PROFESSIONAL ELECTIVE - IV
(v) STRUCTURAL ANALYSIS BY MATRIX METHOD

Learning Objectives of Subject:

1. To introduce students, matrix-based approach for linear elastic analysis of skeletal structure by using stiffness method/ flexibility method.
2. To form the bridge form basic subject like structural analysis to more advanced analysis subjects such as finite element method/analysis
3. To enable the student to have a good grasp of all the fundamental issues in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.

Course outcomes: At the end of this course students will be able to-

1. Analyze simple structure using flexibility method,
2. Analyze simple structure using stiffness method (structure approach)
3. Analyze structure (truss, continuous beam, plane frame etc.) using stiffness method (member approach)
4. Understand basic programming/ flowchart aspects of structural analysis programs.

SECTION A

Unit I: Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility coefficients, stiffness coefficient, flexibility and stiffness matrices of beam and plane truss elements.

Unit II: Flexibility method, Advantages, Disadvantages, basic determinate structure, redundant, alternate choices of redundant and corresponding primary structures, matrix formulation, Analysis using flexibility method of simple problem on truss, beams, frames, up to two unknown.

Unit III: Stiffness method(structural approach), unknown joint displacements for various structures, joint equilibrium equations, Analysis of simple problems of beams, frames, trusses up to three unknowns using Stiffness method (structural approach).

SECTION B

Unit IV: Stiffness method (member approach), Formation of member stiffness matrix, Transformation of load vector and displacement vector, Formation of global stiffness matrix, Solution of equations, member end forces, Analysis of plane trusses.

Unit V: Stiffness method (member approach), Formation of member stiffness matrix, Transformation of load vector and displacement vector, Formation of global stiffness matrix, Solution of equations, member end forces, Analysis of beams and plane frames.

Unit VI: Special analysis procedures ï static condensation, Analysis of beams and plane frames. Programming aspects, flow charts. Introduction to FEM

Reference Books:

1. Pandit G.S. and Gupta S.P., Structural Analysis A matrix approach, Tata Mc Graw Hill, New Delhi 1986
2. Gere J.M. and W.Weaver, Analysis of framed Structures, D.Van Nostrand com. Inc.,Affiliated East West Press, 1965
3. Meghre A.S. and Deshmukh S.K., Matrix Methods of Structural Analysis, Charotar Publishing, Anand, India 2003.

8CE04 : PROFESSIONAL ELECTIVE - V
(i) ADVANCED GEOTECHNICAL ENGINEERING

Learning Objectives of Subject:

- To study the clay mineralogy in detail.
- To learn about the concept of seepage discharge in anisotropic medium.
- To know the concept of three dimensional consolidation of soil.
- To understand the behavior of expansive soil.
- To study the stability of infinite and finite slope.
- To understand the concept of soil stabilization and to know the use of geosynthetics material.

Course Outcomes: At the end of the subject the students will be able ï

- To explain the structure of different clay mineral groups and their physical properties.
- To calculate the seepage discharge in anisotropic medium.
- To compute the degree of consolidation of soil.
- To recommend suitable type of foundation for expansive soils.
- To analyze the stability of infinite and finite slope.
- To suggest the suitable method of soil stabilization and to recognize the major geo-synthetics applications and
- their significance.

SECTION-A

Unit I : Clay mineralogy: Introduction, atomic bonds, classification and nomenclature, structure of clay mineral, Kaolinite. Illite and Montmorillonite groups, physical properties, clay-water relations, diffused double layer, thixotropy, base exchange capacity formation of different structure in soil deposites, electrical effects, electro osmosis, electrophoresis, stemming potential, zeta potential, clay mineral identification, DTA analysis, X ray diffraction method.

Unit II: Seepage : Flow net for anisotropic soil media, construction of flow net for hydraulic structure on non-homogenous soil, directional variation of permeability in aniosotropic medium. Numerical analysis of seepage in layered soil computation of seepage force, seepage through earthen dam resting on confined and unconfined medium entrance discharge and Transfer condition of line of seepage through earth dam.

Unit-III: Three dimensional consolidation. Equation, solution of 3dimensional consolidation equation, consolidation by vertical sand drain and its design aspect, free strain consolidation with no smear, effect of smear zone on radial consolidation. Calculation of the degree of consolidation with radial drains and solutions of problems based on this.

SECTION – B

Unit IV: Expansive soils: orgin of soil, intensification of expansive soil, swelling potential, factors affecting the swelling, different systems of classification, concept of swelling pressure and its measurements in the laboratory, special constructional measures adopted for the construction on expansive soils, special foundations adopted for the construction in expansive soils, concept of cohesive non-swelling techniques and its effect on expansive soil.

Unit V: Stability analysis : Stability analysis of infinite and finite slope, causes of failure of slopes, Stability analysis of infinite and finite slope in cohesive and non cohesive soils, Taylorôs stability number, Friction circle method and Swedish circle method.
Soil stabilization concept of mechanical stabilization, physical and chemical stabilization with organic and inorganic material like line, cement, lime, fly ash and mechanisms, various factors affecting stabilization.

Unit VI: Geosynthetics: types, specifications, functions and various applications in the field of Geotechnical engineering. Reinforced earth, mechanism of reinforced earth, various constructional methods and its effect towards altering, the properties of soil, field situations for application of this techniques.

Books Recommended:

1) Scoth R.F. : Principles of Soil Mechanics.
2) Das B.M. : Advanced Soil Mechanics.
3) Terzaghi : Theoretical Soil Mechanics.
4) Proceedings of Indian Geotechnical Conference, Dec. 22-24, 2013, Roorkee.
5) Proceedings of first Indian Geotextile Conference, Dec. 08-09, 1988, IIT, Bombay.

8CE04: PROFESSIONAL ELECTIVE V
(ii) ADVANCED STRUCTURAL ANALYSIS

Course Learning Objectives:
This course will cover the theory of structural response to dynamic loads. Students will learn

- To mathematically describe the response of SDOF systems with and without damping
- To mathematically describe the response of SDOF systems subjected to free vibration, harmonic, and arbitrary excitations.
- To prepare lumped mass systems including modal analysis of MDOF systems.
- To understand fundamental of elastic foundation and have an insight on soil-structure interaction problems.
- To aware students regarding nomenclature of stress-strain coordinate system and its associated relationship.

Course outcomes: At the end of the subject the students will be able to -

- Formulate the equation of motion for dynamics analysis of structures
- Demonstrate an understanding the assumptions and limitations of the structural dynamics theories.
- Find the response of SDOF systems with and without damping
- Find the response of SDOF systems subjected to free vibration, harmonic, and arbitrary excitations.
- Solve engineering problems in the context of structural dynamics.
- Students will be able to differentiate, analyze structures on firm base and elastic base foundations.
- By virtue of stress-strain relationship, advance aspects of stress-strain resultants allied with plates and shell can be understood.

SECTION - A

Unit I: Equation of Motion, Mass, Stiffness, and Damping. Ground Excitation and Rotational Motion. Free Vibration Single Degree of Freedom Systems (with and without damping). Definition of natural frequency/period. Simple harmonic motion. Effect of damping.

Unit II: Harmonic and Periodic Excitation of SDOF systems (with and without damping). Dynamic Response Factors. Resonance. Transmissibility

Unit III: Response to Arbitrary, Step, and Pulse Excitations of SDOF systems (with and without damping) for Unit impulse, Arbitrary Force and Pulse Excitations. Duhamal Method.
Numerical Evaluation of Dynamic Response of SDOF system using Newmarkôs Method.

SECTION - B

Unit IV: Earthquake Response of Structures. Concept of Response Spectrum. Free vibration, Modal analysis, Response of Linear systems and Earthquake analysis of linear systems for Multiple Degree of Freedom Systems.

Unit V: 1) Response spectrum Analysis as per IS 1893:2016

2) Introduction to plastic analysis of steel structure, shape factor, plastic section modulus, Redistribution of moment, upper and lower bound theorems, collapse loads for beams, single bay, single storey portals. Application of the concept in steel structures.

Unit VI: 1) Infinite & Semi-infinite beams resting on elastic foundation subjected to general loading condition.

2) Introduction to theory of elasticity - (treatment in Cartesian co-ordinates), state of stress at a point, stress ï equilibrium equations, strain-components, stress -strain relations, generalized Hookeôs law, strain plane stress and plane conditions, stress and compatibility for 2D.

Books Recommended:

1. Chopra A. K. , Dynamic of Structures, Theory and Applications to Earthquake Engineering , 3rd edition (2007), Prentice Hill (on reserve)
2. Duggal S.K. Earthquake Resistant Design of Structures , Oxford University Press 2007
3. PankajAgrawal , Manish Shrikhande Earthquake resistant design of Structures, Prentice Hall India
4. Timoshenko & Goodier, Theory of Elasticity.
5. Vazirani & Ratwani : Advanced Theory of Structures.

8CE04 : PROFESSIONAL ELECTIVE V
(iii) ADVANCED DESIGN OF R. C. C. STRUCTURES

Learning Objectives of Subject:

- To understand behavior of Flat slab under external loading.
- To understand behavior of retaining wall.
- To understand behavior of combined footing under external loading.
- To understand behavior of simple structure under external loading.
- To learn behavior of portal frame under external loading.
- To introduce basic concept of water tank.

Course outcomes: At the end of the subject the students will be able -

- To analyze and design of Flat slab.
- To analyze and design retaining wall.
- To analyze and design of combined footing.
- To analyze and design of simple structure.
- To analyze and design of portal frame.
- To analyze and design of water tank.

SECTION - A

Unit I:

1. Design of flat slab.
2. Design of Counter fort retaining wall.

Unit II:

1. Design of combined footing.
2. Complete design of simple, small structures like Canopies & Parking shed.

SECTION – B

Unit III:

1) Design of Portal frame up to two bay two storied symmetrical frame for symmetrical loading.
2) Design of circular slab for uniformly distributed load only.

Unit IV:

1. Design of circular tanks with rigid and flexible base resting on firm ground by working stress method. (By IS code Method, IS 3370-2021)
2. Design of circular tanks with rigid base resting on firm ground by Limit State method. (By IS code Method, IS 3370-2021)

Notes:

1) Students should use IS 456:2000, IS 3370-2021.
2) Field visit on any RCC framed structure & foundation, report of the same.
3) Students must be shown video CD, slides, transparencies, and photograph of actual structures.

Books Recommended:

1. Sushil Kumar, Treasure of R. C. C. Design ; STANDARD BOOK HOUSE SINCE 1960.
2. Ashok K Jain : Reinforced Concrete (Limit state Design) (Nem Chand & Bros Roorkee)
3. Dr.Shah V.L. & Karve S.R.: Limit State Theory & design of Reinforced concrete IS 456:2000 (Structures Publication)
4. N. Krishna Raju, Advanced R. C. C. Design; 3rd Edition; CBS PUBLISHERS AND DISTRIBUTOR PVT. LTD.
5. Rajgopalan, K., Storage Structures Hardcover ï Import; Aa Balkema
6. P.C.Varghese : Advanced reinforced concrete Design (PHI Publication)

8CE04 : PROFESSIONAL ELECTIVE V
(iv) ADVANCED WASTEWATER ENGINEERING

Course Objectives:
The objective of advanced wastewater engineering is to extract pollutants, remove toxicants, neutralize coarse particles, kill pathogens so that quality of discharged water is improved to reach the permissible level of water to be discharged into water bodies or for agricultural land.

Course Outcomes: At the end of the course students will:
1. Have knowledge regarding different types and sources of wastewater.
2. Apply advanced technologies in Wastewater treatment.
3. Select the most appropriates types of membrane processes for tertiary treatment of wastewater.
4. Apply advanced oxidation processes to treat concentrated non biodegradable wastewater.
5. Learn sludge handling and disposal processes.

SECTION A

Unit I: Water Pollution and Treatment: Types and Sources, quality of water, various stages of treatment of Water treatment process: aeration, Sedimentation, Filtration: slow and rapid sand filters.
Unit II: Biological nutrient removal: Nitrogen removal: nitrification, denitrification, processes for biological nitrogen removal, phosphorous removal mechanism; application of phostrip, bardenpho and phoredox process.
Unit III: Membrane Separation: Membrane process terminology & classification, Materials, membrane configuration, membrane operation, ultra filtration, reverse osmosis, microfiltration, Nanofiltration: Applicability, limitations, advantages and disadvantages, membrane fouling, electro dialysis, membrane bioreactors.

SECTION B

Unit IV: Adsorption: Types of adsorbents, fundamentals of adsorption, adsorption isotherm, activated carbon adsorption kinetics, activated carbon treatment.
Ion Exchange: Fundamentals of ion exchange, types of ion exchange resins, general characterization of ion exchange resins, theory and application of ion exchange.

Unit V: Advanced Oxidation Process: Theory of advanced oxidation, technologies used to produce hydroxyl radicals, applications.

Unit VI: Sludge handling and disposal: Sludge processing steps- Preliminary operations, thickening, stabilization, conditioning, dewatering and heat drying and thermal reduction. Aerobic and anaerobic sludge digestion microbiology and design, land application of sludge and design consideration. Sludge storage, land application of domestic sewage and ground water recharge.

BOOKS RECOMMENDED:
1. Wastewater Engineering: Treatment, disposal, Reuse (4th ed.) - Metcalf & Eddy Inc. Tata McGraw-Hill, New Delhi, 2003.
2. Wastewater Treatment for Pollution Control (2nd ed.) - SJArceivala, Tata McGraw-Hill, 1998.
3. Wastewater Treatment Plants: Planning, Design and Operation Holt - SR Qasim, Rinehart & Winston, NY, 1985
4. Wastewater Treatment ï DW Sunderstorm and HE Klei, Prentice-Hall, Englewood Cliffs, NJ, 1979.
5. Biological Wastewater Treatment: Theory and Application - CLP Grady, and HC Lim, Marcel Dikker, NY, 1980.
6. Punmia B. C. ñWastewater Engineeringò. Laxmi publication.

8 CE04 : PROFESSIONAL ELECTIVE V
(v) CONSTRUCTION EQUIPMENT AND MACHINERY

Learning Objectives of Subject:
- Student should learn about the basic terms related to construction machinery and equipments.
- Student should understand use of various equipments and tools in sequence of Project Life cycle.
- Student should be able to know the application of Survey tool and basic construction minor tools.
- Student should know about various equipment and machinery related to excavation and dumping work like excavator, Machine Shovel , Hoe etc.
- Learner should know about various material mixing machinery like Rotating drum concrete mixer, transit mixer etc.
- Learner should study about compacting machine and tools like various vibrators and rollers.
- Student should know about various material movement equipment like crane , hoist and lifts etc.

Course outcomes: At the end of the subject the students will be able -
- To recognize the various terms related to the tools that are required for any construction work.
- To decide which machine or tool can be implemented as per the project life cycle stage.
- To understand the survey process with help of Total station and will be able to analyze the performance of basic minor tools and machinery
- To understand various equipments like excavators, shovels, mixers, compactors , crane , hoist , lift etc.

SECTION A

Unit I: Basics of Construction Equipment and Machinery ï History of Construction Equipments and Tools, Need of utilizing equipments and Machinery in Construction work. Understanding Terms like operating time, Idle time, Capacity, Efficiency of Machine, depreciation and obsolesce cost of machines and equipments. Purchase, Rent and Lease considerations while using Machine or Equipments. Factors affecting selection of Machinery, General Safety rules and measures while using equipments, tools and machinery at time of construction.

Unit II : Land Survey Equipments and essential Tools- Need for survey equipments , Application of Total Station for land survey and layout work. Introduction to Drone surveying and mapping method. Tools like Hoe, Head pan, Masonry Trowel , Wheel barrow , Wooden Float , Plumb Bob , Line Level etc.

Unit III : Excavating & Dumping Machines :- Components , Capacity , Working method of Excavator , Front Shovel , Loaders and Back Hoe.

SECTION B

Unit IV : Mixers - Components , Capacity , Working method of Batch mixers, Drum Types Mixer, Tilting drum mixers, Non-tilting drum mixer, Reversing drum mixer, Pan Type Mixer , Concept & Types of Continuous Concrete Mixer ï Transit Mix trucks/ Ready mixed Concrete Mixers.

Unit V: Compacting Equipments, Tools & Machinery:
Vibrator ï Its need and types ï Internal/ needle, surface, vibrating table & surface vibrating machine. Details of Rollers and its types ï Sheep Foot, Tamping , Smooth drum vibratory soil compactors , Pneumatic- tired rollers.

Unit VI: Material handling Equipments, Tools & Machinery: Components , Capacity , Working method of various Cranes ï Tower , Mobile, Truck mounted Rough Terrain, Overhead .
Components, Capacity, Working method of Loader, Conveyors, Lifts , Hoist & Forklift.

8CE04 : PROFESSIONAL ELECTIVE - V
(vi) FINITE ELEMENT METHOD

Course Learning Objective:
The aim of the course is to provide the students an overview on Finite Element Method, Material models, and Applications in Civil Engineering.

Course outcomes: At the end of the subject the students will be able to -
1. Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer.
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems.
4. Implement and solve the finite element formulations using software.

SECTION – A

Unit I: Introduction to Finite Element Method, its application, Steps in Finite Element Analysis, Advantage/ Disadvantages, Virtual Work and Variation Principle, : Galerkin Method, Displacement Approach, Stiffness Matrix and Boundary Conditions.

Unit II: Finite Element and Interpolation Functions/shape function, One dimensional Element (Line, Quadratic, cubic, Lagrangian form, higher order), Two dimensional Element (Triangular element- linear / quadratic, Rectangular element, Isoparametric, Serendipity element), Three dimensional Element (Tetrahedral element, Prismatic element)

Unit III: One dimensional Finite Element Analysis; Linear spring, Truss element, one dimensional fluid flow thro porous media, steady state heat conduction, solutions of simple engineering 1D problems.

SECTION – B

Unit IV: One dimensional Finite Element Analysis; 1) Beam Element, review of beam theory, FE formulation of beam element, solutions of engineering problems. 2) Analysis of plane frame, Transformation Matrix, solutions of engineering problems

Unit V: Two dimensional Finite Element Analysis; 2D Continuum Structures: Plane stress and plane strain analysis by constant strain triangle (CST), rectangular element, Isoparametric Elements, development of element stiffness matrices, load vectors and solution.

Unit VI: Three dimensional Finite Element Analysis; Development of element stiffness matrices and load vectors using Axi-symmetric solids, tetrahedron, eight node brick element, Isoparametric Elements. Introduction to FEMsoftwareôs STAAD, RAM Product, NISA, MSC Nastron, ANSYS, ABAQUS, MIDAS, CRISP, PLAXIS etc.

Books Recommended:

1. Introduction to Finite Elements in Engineering, Chandragupta T. R. and Belegundu A. D., 3rd Edition, Prentice Hall, 2002.
2. Finite Element Method in Structural Analysis, A.S.Meghre and Ms. K.N.Kadam, First Edition, Khanna Publishers, 2014.
3. Finite Element Analysis: Theory and Programming: C. S. Krishnamurthi Second Edition, Tata McGraw Hill Publishing Company Limited, 1994
4. O. C. Zienkiewicz., R. L. Taylor & J. Z. Zhu., ñThe Finite Element Method Its Basis & Fundamentalsò, Elsivier Publications, 2007

8 CE05: CONSTRUCTION ECONOMICS & ESTIMATING – COSTING – LAB.

1. Writing specification for 5 items that includes Building Work, Road work, Irrigation work etc.
2. Rate Analysis of 6 items like Cement, Sand, Steel, Brick, Paver and Timber etc.
3. Preparation of BAR bending Schedule.
4. Manual & Software Application for detail estimate of Residential Block with 4 rooms only.
5. Quantity & Rate Estimate of small Commercial building.
6. Quantity & Rate Estimate of Rigid/ Flexible Pavement Road for stretch of 1 km only.
7. Valuation of small building/ flat for any existing structure.

Note: - Faculty should carry out Mock exercise for Tendering & Bidding Process among the concern class students.

8 CE06 : P.E. IV (i) ADVANCE DESIGN OF STEEL STRUCTURE- LAB.

Practicals:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any Steel framed structure & report of the same.

8CE06: P.E. - IV (ii) ADVANCED PRESTRESS CONCRETE STRUCTURES-LAB.

Practicals:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any Prestressed structure & report of the same.

8CE06 P.E. - IV (iii) ADVANCED WATER TREATMENT- LAB.

List of Experiments: Minimum 8 practicals out of the given should be performed. The site visit is compulsory.

1. Determination of Turbidity of water sample.
2. Determination of pH of water sample.
3. Determination of Electrical Conductivity of water sample.
4. Determination of Chlorides.
5. Determination of suspended, settleable, volatile & fixed solids.
6. Determination of hardness of water sample.
7. Determination of Optimum Coagulant dosage.
8. Determination Dissolved oxygen and BOD for the given sample.
9. Determination of COD for given sample.
10. Report of Field visit to Municipal Water Treatment Plant.

8CE06: P.E. - IV (iv) INDUSTRIAL WASTE WATER TREATMENT- LAB.

List of Experiments: Minimum 8 practicalõs out of the given should be performed. The site visit is compulsory.

1. Determination of Alkalinity and Acidity
2. Determination of Dissolved oxygen
3. Determination of Biochemical Oxygen Demand
4. Determination of Chemical Oxygen Demand
5. Determination of suspended, settleable, volatile & fixed solids.
6. Determination of Oil & Grease.
7. Determination of Phosphates and Sulphates.
8. Determination of SVI of Biological sludge
9. Metal analysis from Industrial Wastewater a) Arsenic b) Nickel c) Chromium
10. Report of Field visit to Industrial Waste Water Treatment Plant.

8CE06 : P.E. - IV (v) STRUCTURAL ANALYSIS BY MATRIX METHODS – LAB.

(Any five)

1. Analysis of axially loaded member/ problem using stiffness method/ flexibility method and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
2. Analysis of Continuous beam problem using structural approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
3. Analysis of Continuous beam problem using member approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
4. Analysis of Truss problem using member approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
5. Analysis of Plane frame problem using member approach hand Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
6. Prepare computer program for Matrix addition, subtraction, multiplication, inverse using C/FORTRAN language.

Prepare computer program to form Stiffness matrix for 1) Truss element, 2) Beam Element, 3) Plane frame Element using C/FORTRAN language

8 CE07 : PROJECT & SEMINAR

As per the details in the scheme of B.E (Civil Engineering).

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