

SYLLABUS OF HYDRAULIC ENGINEERING SECTION
CE-213 Fluid Mechanics

Course Category: DC

L - T - P: 3 - 1-0

Credit: 4

This is the first basic course of fluid mechanics. The main objective of this course is to understand the fundamentals of the fluid mechanics such as fluid and flow properties, fluid behavior at rest and in motion and fundamental equations like mass, energy and momentum conservation of the fluid flow. Applications of these basic equations have been highlighted for flow measurements through orifice, mouth piece, weirs, Venturimeter, sluice gates etc. The whole course has been divided in four units as described herein.

Unit 1: Kinematics of fluid flow: Introduction, Fluids Properties and classification; Concept of viscosity, Compressibility and Elasticity, Surface tension and capillarity. Flow Classification, Stream lines, Streak lines, Continuity equation, Velocity, Tangential, Normal, Local and Convective Accelerations, Types of fluid motions, rotation, Circulation, Velocity potential, Stream function, Flownet.

Unit 2: Hydrostatics: Pascal law, Hydrostatic law, Relative equilibrium, Pressure measurements, Mano-Meters, Forces on immersed plane and curved surfaces, Buoyancy, Stability of floating and submerged bodies.

Unit 3: Equation of Motion: Bernoulli's equation, Energy correction factor, Coefficients of contraction, velocity and discharge, Differential head meters, Free vortex motion, Analysis of free liquid Jet, Cavitation. Linear momentum equation, Force on pipe junctions and bends, Forces on moving plates and vanes due to fluid flow, Angular momentum, Forced vortex.

Unit 4: Flow Measurement: Orifices, Mouth pieces, Weirs, Flow under sluice gates. Time of emptying tanks with or without inflow, Flow of liquid from one vessels to another.

Text/Reference Books

1. P.N. Modi and S.N. Seth, "Hydraulics and Fluid Mechanics", Standard Book House, Delhi, India.
2. S. Ramamnitham, "Hydraulics and Fluid Mechanics", Dhanpat Rai & Sons, Delhi, India.
3. Shames, "Mechanics of fluids", Mc Eraw-Hill, Auckland, N. Land.
4. V.L. Streeter, "Fluid Mechanics", Mc Graw-Hill, N.Y.,USA.
5. R.J. Garde, "Fluid Mechanics" RPH, Roorkee, India.

CE-292 Fluid Mechanics Lab

Course Category: DC

L - T - P : 0 - 1 - 2

Credit: 2

List of Experiments:

1. Flow over weirs and notches
2. Verification of Bernoulli's Theorem
3. Discharge through an Orifice
4. Centre of Pressure
5. Impact of Liquid jets
6. Head losses through sudden contraction and enlargement

CE-219 Hydrology

Course Category: DC

L - T - P : 3 - 1 - 0

Credit: 4

This is the first course of hydrology. The aim of this course is to understand the basic concepts of hydrology and it emphasizes the various methods for the measurements and assessment of precipitation, evaporation, surface runoff, and ground water etc.

Unit 1 Scope and applications of hydrological cycle, Hydrology applied in Engineering, Precipitations types and measurement, Rain gauge, Network analysis of rainfall data.

Unit 2 Evaporation, Evapo-transpiration, Consumptive use, infiltration and percolation, methods of determination, factors affecting.

Unit 3 Surface runoff, factors affecting, measurement of runoff, Analysis of runoff data, Hydrographs, Mass curve and Flow duration curve, Concept of Unit Hydrograph, Methods of Estimation of Unit Hydrograph, Derivation and application.

Unit 4 Ground Water Hydrology, Definitions, Types of Aquifers and Wells, Occurrences, Distribution, Darcy's law and its limitations, Well hydraulics.

Text / Reference Books:

1. K. Subramanya, "Engineering Hydrology", TMH, New Delhi, India.
2. Chow V.T., "Hand book of Applied Hydrology", Mc Graw-Hill, N.Y., USA.
3. Wister, and Kohler and Paulhus, "Hydrology", McGraw Hill, Tokyo, Japan.
4. Linsley, Kohler and Paulhus, "Applied Hydrology", Mc Graw Hill, N.Y., USA.
5. D.K Todd, "Groundwater Hydrology", John Wiley, N.Y., India.
6. J. Nemec, "Engineering Hydrology", Mc Graw-Hill, N.Y., India.

CE-316 Engineering Hydraulics - I

Course Category: DC

L - T - P: 3 - 1 - 0

Credit: 4

The main aim of this course is to understand the basic theories of laminar flow, turbulent flow, boundary layer, dimensional analysis & model studies etc. It also deals with the application of these theories for the Civil Engineering Problems such as pipe design, pipe network analysis, three reservoir problems, water hammer analysis, drag and lift, turbines and pumps etc. The whole course has been divided into four units as described herein.

Unit 1 Laminar flow, Navier's-Stokes equation of motion for laminar Flow; Laminar flow between two parallel plates, laminar flow through pipes, Dimensional Analysis & Modal Studies. Velocity distribution in turbulent flow; shear stress due to turbulence, turbulent flow in circular pipes, resistance of smooth and artificially roughened pipes, General resistance diagram.

Unit 2 Boundary Layer Theory: Introduction, Development of boundary layer over a flat plate, boundary layer thickness, displacement, momentum and energy thicknesses, Application of momentum equation to boundary layer flow, local and mean drag coefficients, Hydro-dynamically rough and smooth surfaces, boundary layer separation and its control, Forces on Immersed bodies: Drag and lift, drag on flat plate, sphere, cylinder and disc, development of lift, Magnus effect and circulation, theoretical lift on rotating cylinder.

Unit 3 Pipe Flow Problems: Losses in pipe flow, pipes in series, pipes in parallel, branching pipes, siphons, multi-reservoir problems, pipe net works, unsteady flow in pipes, water hammer analysis.

Unit 4 Hydraulic Machines: Turbines: classification of turbines, Impulse and Reaction turbines, characteristic curves, draft tubes, Pumps: classification of pumps, centrifugal pump, efficiency and power, Output of centrifugal pumps, characteristics curves.

Text / References Books:

1. V.L. Streeter, " Fluid Mechanics", Mc Graw-Hill, N.Y, USA.
2. R.J. Garde "Fluid Mechanics" RPH, Roorkee.
3. Shames , "Mechanics of fluids" Mc Graw-Hill (Int. St. ed.) Auckland, NZ.
4. A.K. Jain "Mechanics of fluids", Khanna Publisher., Delhi.

CE-396 Hydraulics Lab

Course Category: DC

L - T - P : 0 - 1 - 2

Credit: 2

List of Experiments

1. Flow through pipes
2. Flow through Venturimeter
3. Determination of viscosity by capillary tube viscometer
4. Determination of viscosity by falling sphere viscometer
5. Flow visualization using Reynolds apparatus
6. Flow through bend meter

CE-414 Engineering Hydraulics - II

Course Category: DC

L - T - P: 3 - 1 - 0

Credit: 4

The main aim of this course is to understand the basic theories of open channel flows such as depth- energy relationship, uniform flow and its application to design of efficient channel sections of various shapes, hydraulic jump and its application to the energy dissipation devices, gradually varied flow and its application in computation of typical water surface profiles, unsteady flow and its practical application, model studies and their application in open channel flow etc .

Unit 1: Basic Principles: open channel flow and its classifications, and properties, energy and momentum principles, Critical flow computation and its applications, transitions with sub critical and super critical flows.

Unit 2: Uniform flow, roughness coefficient, computation of uniform flow in prismatic channel, design of non- erodible channels for uniform flow, Most efficient channel section, compound sections

Unit 3: Gradually varied flow: Theory and analysis, gradually-varied flow computations in prismatic channels, gradually varied flow in non-prismatic channels. Rapidly varied flow: Theory of hydraulic jump, evaluation of jump elements in rectangular and non-rectangular channel, location of jump on horizontal floor, channel controls and transitions, free over fall, thin plate weirs, broad crested weirs, and sluice gates.

Unit 4: Application of model studies to free surface flow problems, waves and their classifications, celerity of a wave, surge formation, equation of motion, rapidly varied unsteady flows.

Text/Reference Books:

1. Subramanya, "Flow in Open channels"
2. K G Ranga Raju, "Flow through open channel"
3. V.T chow "Open channel Hydraulics"
4. Bakhmeteff, "Hydraulics of open channel"
5. Henderson, "Open channel flow"

CE-415 Irrigation Engineering

Course Category: DC

L - T - P: 3 - 1 - 0

Credit: 4

The main theme of this course is to understand the theory and design of irrigation structures in the Indian sub-continent. The course covers the major topics such as assessment of water requirement

for various crops, design of canals, headwork, regulation works, cross drainage works and river training works etc. Various types of irrigation and the related problems such as water alkalinity and water logging are also highlighted.

Unit 1: Irrigation development in India, present status of irrigation in India, methods of irrigation, silt control in canal, canals outlets. Water requirements of various crops and land leveling, Irrigation schedule.

Unit 2: Canal losses, water-logging and lining of canals; Regime theories for the design of earthen channels, elementary ideas about sediment transport theory, incipient motion of sediment. Modes of sediment transport.

Unit 3: Theory of uplift pressure, canal headwork, river training works.

Unit 4: Canal regulation and cross drainage works.

Text / References Books:

1. P.N. Modi, "Irrigation Water Resources and Water Power"
2. Bharat Singh, "Irrigation Engineering"
3. S. K., "Garg Irrigation Engg. and Hydraulic Structures"

Course Category: DC **CE - 490 Project**
L - T - P : 1- 2 - 0 **Credit: 8**

Any suitable topic with the aim of providing training in the areas of analysis, design, development of new ideas in civil engineering, including collection of data, making drawings, cost estimate and writing report.

Course Category: DC **CE-493N Irrigation Design of Works**
L - T - P : 0 - 1 - 2 **Credit: 2**

The aim of this course is to provide the thorough idea of designing and detailing of some typical irrigation structures.

Design and detailing of canals, falls, and diversion works, cross drainage works are of particular interest.

Course Category: DE **CE-424 Ground Water Engineering**
L - T - P: 3 - 1 - 0 **Credit: 4**

The main aim of this course is to get insight of the ground water resources, the fundamental principle of the ground water flow, well hydraulics, ground water exploration, and pumping test etc.

Unit 1: Ground water Resources, Occurrence of Ground Water, Flow of Water through porous Media, Aquifer properties, Flow net.

Unit 2: Ground water flow problems. Steady flow in unconfined Aquifer with recharge. Steady flow in confined Aquifers of constant and variable thickness, Tile Drain Problem.

Unit 3: Well Hydraulics. Steady Radial Flow into well, Partial Penetrated well, Spacing of wells, well losses. Design of water wells, Methods of well construction.

Unit 4: Ground water Exploration, Pumping Test. Introduction to Unsteady flow into wells. Flow through leaky aquifers.

Text / Reference Books:

1. Bauwe, H., "Ground water Hydrology"
2. Chow V. T., "Hand Book of Applied Hydrology", Mc Graw-Hill, N.Y., USA.
3. K.C. Patra, "Hydrology and water process Engg."
4. G.L. Asawa, "Irrigation Engg" , New Age, New Delhi, India.
5. M.C. Graq, "Ground water Resoucess Evaluation" McGraw-Hill, N.Y., USA 1970
6. Todd D.K., "Ground water Hydrology", John Wilay and Sons, N.Y.,USA.

CE - 425 Advanced Hydrology

Course Category: DE

L - T - P: 3 - 1 - 0

Credit: 4

This is the second course of the hydrology at the undergraduate level. It covers the interaction between meteorology and precipitation, intensity - duration frequency analysis, flood estimation and flood routing, Statistical methods in the hydrologic analysis and design and some advanced topic in hydrograph analysis have also been covered .

Unit 1: Water availability, Meteorology, Probable maximum precipitation, Depth area duration relationships, Frequency of point rainfall, Intensity Duration frequency relationship.

Unit 2: Flood estimation and flood routing: General, Design flood, estimation for ungauged and gauged water sheds, probable maximum flood, Routing classification, Reservoir routing, Hydrological Channel routing. **Unit 3** Statistics in Hydrology: General probability distributions, Moments of distribution, Distribution characteristics, Forms of Probability distributions, frequency Analysis, Reliability of Statistical analysis, fitting of a Probability distribution.

Unit 4 Unit Hydrograph, Unit Hydrograph for ungauged water sheds, Instantaneous Unit Hydrograph, Bernard's distribution graph.

ext / Books References:

1. K.C. Patra, "Hydrology Water Resources Engineering."
2. P. J. Reddy, "A Text Book of Hydrology"
3. K. Subramanya, "Engineering Hydrology" TMH, New Delhi, India.
4. S. N. Davis and R. J. M. Deisiest, "Hydrology", Mc. Graw-Hill, N.Y., USA.
5. D. K Tood, "Ground Water Hydrology", John Wily, N.Y., USA.

CE-428 Dam Engineering

Course Category: DE

L - T - P: 3 - 1 - 0

Credit: 4

The course emphasizes on the basic design principle of the gravity dam, earthen dam, arch and buttress dam, spillways and energy dissipaters etc.

Unit 1 Types of Dam, merits and demerits, dam site selection, selection of dam, Forces acting on gravity Dam, Methods of analysis of gravity Dam, Modes of failure and stability requirements, Design criteria and factor of safety.

Unit 2 Elementary profile of a gravity dam, Low and high gravity dams, Zoning of dams, Galleries in dams, Temperature control in mass concrete; gravity dams subjected to earthquakes.

Unit 3 Buttress and Arch dams, Types, selection, merits and demerits, Elementary design Principles of Arch and Buttress dams.

Unit 4: Earth Dam their component and functions, causes of failure. Factors influencing the design of an earth dam. Design criteria for Earth Dam. Elementary idea of design for spillway and energy dissipaters.

Text / References Books:

1. R.S. Varshney "Concrete Dams", by 1982, NCB, Roorkee
2. IS: 6512-1984, Is Code for criteria for Design of solid Gravity Dams.
3. Design of Swell Dams, USBR 1960, Calcutta, Oxford and IBH
4. W.P. Creager, J. Justin, Daud Hinds, "Engineering for Dams" vol.I-III, Wiley, N.Y., USA.

CE-432 Water Power Engineering

Course Category: DE

L - T - P: 3 - 1 - 0

Credit: 4

The main aim of this course is to provide the basic concepts of water power engineering such as power potential of stream, firm power and secondary power, hydropower plants, intake structures, turbines, surge tanks, water hammer analysis etc .

Unit 1: Introduction, sources of energy, water power development, power requirements, load studies, power available, power potential of stream, storage and pondage studies.

Unit 2: Hydro-power plants, classification, elements, Firm and secondary powers, load factor, utilization factor, plant factor.

Unit 3: Intakes, tunnel, penstocks and draft tubes, Water hammer analysis, surge tanks, classification, working principle.

Unit 4: Turbines, main features, performance, selection, capacity, salient features.

Text / Reference Books:

1. Dandekar and Sharma, "Hydro Power Engineering"
2. Varshney, "Hydro Power Structures" NCB, Roorkee, India.

CE-436 Sediment Transport

Course Category: DE

L - T - P: 3 - 1 - 0

Credit: 4

The aim of this course is to provide basic concepts of sediment transport such as sediment properties, initiation of sediment motion, flow regime, sediment load assessment and river models etc.

Unit 1: Introduction: Properties of sediment, Settling Velocity of particles, Effect of particles on the viscosity.

Unit 2: Scour Criteria and Related Problems. Critical Velocity equations Critical Shear- stress equations. Lift force Mechanism.

Unit 3: Introduction, Bed Load equations, Schoklitch type equations, Einstein's Bed load equation, Suspended load, Total load.

Unit 4: Bed Form Mechanism, Sediment Measuring Devices, Model Laws.

Text / Reference Book:

1. W.H Graf, "Hydraulics of Sediment Transport", Mc Graw-Hill, N.Y.,USA.
2. R.G. Garde and Ranga Raju, "Mechanics of Sediment Transport", Wiley, New.Delhi, India.

CE - 440 Advanced Hydraulic Structures

Course Category: DE

L - T - P: 3 - 1 - 0

Credit: 4

This course covers the advanced topics of hydraulic structures and their detailed design.

Unit 1: Introduction: Minor Irrigation Projects, crops and crop seasons, Canal Irrigation, Canal outlets, Canal Regulation, Design of retaining walls.

Unit 2: Design of Canal falls, Design of distributary's head Regulator and Cross Regulator, Canal Escapes Design of Intakes and Canal Drop.

Unit 3: Design of Cross- Drainage structures, uplift pressure under weir, protection works.

Unit 4: Sediment Control Devices.

Text / Reference Books:

1. C. S. Murty, "Design of Minor Irrigation and Canal Structures"
2. Baban, "Design of Diversion Weirs"
3. G. L. Asawa "Irrigation Engineering"

CE - 483 Water Resources and Watershed Management

Course Category: DE

L - T - P: 3 - 1 - 0

Credit: 4

The basic aim of this course is to understand the surface water resources and its management including environmental impact assessment, project economics, water quality management planning, and design of water resources systems etc.

Unit 1: Types of watershed and their characteristics. Purpose of planning of watershed projects, Guidelines for project formulation, Management strategies, system concept, systems components and constraints.

Unit 2: Hydrologic cycle and its effect on man's activity, erosion process and sediment yield, conservation practices, water resources and environmental problems, water quality management planning, Design of water resources systems.

Unit 3: Environmental impact assessment, adverse effects of dams and reservoir on environment, watershed management with multiple use concepts.

Unit 4: Project economics: pattern of financing and credit, cost benefit analysis, Economic evaluation, project implementation and management, problems of execution and management.

Text / Reference Books:

1. K.C. Patra, "Hydrology and water Resources Engineering"
2. S. K. Garg, "Irrigation Engineering"

SYLLABUS OF ENVIRONMENTAL ENGINEERING SECTION

B.Tech. (Civil Engineering)

CE 111 Environmental Studies

CE-313N Environmental Engineering

Departmental Electives (DE) for the students of B. Tech (Civil Engineering)

CE 422 Ecology & Environment

CE426 Environmental Pollution Abatement

CE429 Industrial Pollution Control

CE442 Advanced Environmental Engg.

Open Electives* (OE) offered by Civil Engineering Department

CE 481 Fundamentals of Environmental Engineering

CE111 Environmental Studies (3-1-0-4)

Unit I

Concepts of Ecology: Ecosystem, Energy and nutrient flow in ecosystem, Food chain, Environmental Segments: Atmospheric Structure, Classification of air pollutants, sources of air pollution and their effects on human health and property. Atmospheric chemistry, Photochemical Smog, Ozone depletion.

Unit II

Air Quality and Standards, Meteorological phenomena and their influence on Air Quality, Lapse rates, Dispersion of Pollutants.

Air Pollution Control: Introduction to Particulate and Gaseous pollutant control.

Unit III

Water Quality: Physical, Chemical and Biological parameters. Water quality standards, Biochemical (BOD) and Chemical Oxygen Demand (COD). BOD/COD Calculations

Environmental Analyses: pH, Alkalinity, Conductivity, Ammonia, Fluoride, Sulphate, Chloride. Analysis and measurement of gaseous pollutants.

Unit IV

Water purification processes in natural systems: Dissolved Oxygen (DO), Impact of wastewater discharge on streams, Oxygen Sag Curve.

Introduction to Water Treatment Technologies: Sedimentation, Coagulation and Flocculation, Hardness Reduction, Filtration and Disinfection.

Unit V

Wastewater Characteristics, Introduction to wastewater treatment technologies. Primary Treatment: Screening, Grit Removal, Flow measurement, Flow equalization. Secondary Treatment: Microbial growth curve, Suspended and Attached growth systems.

Unit VI

Solid Waste: Classification, Sources and Characteristics.

Waste Management: Solid Waste Generation, Collection, Processing and Disposal Methods.

Resource Recovery in Waste Management, Biological and Thermal Conversion Processes.

Reference Books:

1. Venugopala Rao, P., 2006, *Principles of Environmental Science and Engineering*, Prentice-Hall of India Private Limited, New Delhi.
2. Masters, G.M., 1991, *Introduction to Environmental Engineering and Science*, Prentice-Hall International, Inc., Englewood Cliffs, NJ.
3. Peavy, H.S., D.R. Rowe and G. Tchobanoglous, 1985, *Environmental Engineering*, McGraw-Hill Book Company, New York.
4. Henry, J.G. and G.W. Heinke, 1989, *Environmental Science and Engineering*, Prentice-Hall International, Inc., Englewood Cliffs, NJ.
5. Sawyer, C.N. and P.L. McCarty, 1978, *Chemistry for Environmental Engineering*, 3rd Edition, McGraw-Hill Book Company, New York.
6. Tchobanoglous, G., H. Theisen and S. Vigil, 1993, *Integrated Solid Waste Management*, McGraw-Hill Inc. Singapore.

CE – 313N Environmental Engineering

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

Unit 1 Sources of Water Supply, Water demand, variation in demand, Population prediction. Water distribution Systems – types and design. Equivalent pipe and Hardy Cross method.

Unit 2 Water treatment flow sheets, screenings, coagulation, flocculation, filtration, disinfection, hardness reduction, removal of iron and manganese.

Unit 3 Variation in wastewater flow rates, Design of sewers, Wastewater treatment flow sheets, screens, grit removal, sedimentation, activated sludge process, trickling filter, anaerobic digestion.

Unit 4 Stabilization ponds. Onsite treatment and disposal, wastewater irrigation, Disposal techniques for solid and hazardous wastes.

Text Book

1. Howard S. Peavy, et. Al., “Environmental Engineering” McGraw-Hill Book Co.

Reference Book

2. Steel & McGhee, “Water Supply and Sewage”, McGraw-Hill Book Co.

CE-422 Ecology and Environment

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

Principles of ecology, Food chain, Trophic levels, Ecosystems, Biochemistry of natural compounds, Classification of microorganisms, Growth pattern of microorganisms, Biochemical reactions,

Microbiology of aerobic and anaerobic processes, Biochemical pathways, Metabolism, Energy concepts, Pathogenic diseases, Basic microbiology of water air and soil, Application of microbiology for pollution control, Laboratory Practice.

CE 426 Environmental Pollution Abatement

Course Category : DE-II L - T - P: 3 - 1 - 0 Credits: 4.0

Characterization of liquid waste, industrial waste survey, sampling and material balance, segregation and equalization; Disposal of waste in environment, Effects on land and receiving waters; standards.

Wastewater treatment, physical, chemical and biological processes Wastewater reclamation and reuse in industry.

Pollution abatement in major industries: Textile, Paper and Pulp, Steel, Sugar, Distillery, Petroleum Refinery.

Sources and generation of gaseous pollutants, Effects on materials, health and plants, Air quality monitoring, Standards, Meteorology.

Air pollution control, Methods for removal of particulates and gaseous pollutants, Design Principles.

Text / Reference Books:

1. S.P.Mahajan , “Pollution control in industries”, McGraw Hill Co
2. Rao & Dutta, “Wastewater Treatment”, Oxford & IBH Publishers
3. Wark & Warner, “Air Pollution- origin and control” Harper and Collins

CE 429 Industrial Pollution and Control

Course Category: DE-III L - T - P: 3 - 1 - 0 Credits: 4.0

Characterization of liquid waste, industrial waste survey, sampling and material balance, segregation and equalization; Disposal of waste in environment, effects on land and receiving waters, standards.

Wastewater treatment, physical, chemical and biological processes Wastewater reclamation and reuse in industry.

Pollution abatement in major industries: Textile, Paper and Pulp, Steel, Sugar, Distillery, Petroleum Refinery.

Sources and generation of gaseous pollutants, Effects on materials, health and plants, Air quality monitoring, Standards, Meteorology.

Air pollution control, methods for removal of particulates and gaseous pollutants, design principles.

Text / Reference Books:

- 1 S.P.Mahajan , “Pollution control in industries”, McGraw Hill Co.
- 2 Rao & Dutta, “Wastewater Treatment”, Oxford & IBH Publishers
- 3 Wark & Warner, “Air Pollution- origin and control” Harper and Collins

CE - 442 Advanced Environmental Engineering

Course Category: DE/OE L - T - P: 3 - 1 - 0 Credits:4.0

Advanced treatment of water and wastewater, Concept of various unit operations adsorption, ion exchange, reverse osmosis and their application in wastewater reclamation and reuse. Advanced environmental chemistry and microbiology. Waste water disinfection/

Text / Reference Books:

1. R.L. Droste, “Theory and Practice of water and wastewater treatment” Wiley Interscience,
2. Shuval. “Water Renovation and Reuse, “Academic Press
3. Benefield, “Process Chemistry for Water and wastewater Treatment”, Prentice – Hall

CE - 481 Fundamentals of Environmental Engineering

Course Category: OE L - T - P: 3 - 1 - 0 Credits: 4.0

Fundamentals of chemistry concepts in Environmental Engineering, Fundamentals of Microbiology in Environmental Engineering, Fundamentals of physico chemical and biological processes of water and wastewater treatment, Mass balance and energy balance approach, Environmental Pollution and standards – air, water, land and noise

Text / Reference Books:

1. Howard S. Peavy, et. Al., Environmental Engineering” McGraw-Hill Book Co.
2. Sawyer and McCarty, ‘ Chemistry for Environmental Engineering” McGraw-Hill Book Co.
3. McKinney, “Microbiology for Sanitary Engineers McGraw-Hill Book Co.

SYLLABUS OF STRUCTURAL ENGINEERING SECTION

III Semester

CE – 212 Civil Engineering Materials

Course Category : DC L - T - P : 3 - 1 - 0 Credit : 4

- Unit 1 Cement and Aggregates: Methods of manufacturing of cement and its chemistry; Kinds of cement and their properties; Hydration mechanism, Testing of cement; Grading, Shape and texture of aggregates; properties of aggregates.
- Unit 2 Properties of fresh concrete: Tests on fresh and hard concrete; Factors affecting strength of concrete; Durability of concrete, Introduction to mix design – IS code method.
- Unit 3 Bricks: Constituents of brick earth and their properties; Manufacture of bricks, classification and tests for quality control; Properties of masonry units and masonry mortar; Stone their types and uses; Classification of lime, setting of lime, Specifications
- Unit 4 Timber: Structure and characteristics of hard and soft wood; Engineering applications; Defects in timber, Seasoning, preservation, fire proofing; Plywood, black boards and fire boards; Steel; types and mechanical properties (ductility and strength) of mild steel, cold worked steel etc.; Effect of heat and fire resistance.
- Unit 5 Properties and uses of Glass, Asbestos, Bitumen, Plastics etc.; Industry and environment, use of waste; Alternative and non standard construction materials.

Text / Reference Books:

- Naville, A.M., "Properties of Concrete", Longman,
Naville, A.M., "Concrete Technology", Longman,
Gambhir, M. L., "Concrete Technology", TMH, New Delhi, India.
Singh, S., "Engineering Materials", Konark, Delhi, India.

CE – 215 Engineering Geology

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

Unit 1. General Geology: Introduction to the Earth Sciences. Elementary idea about the internal structure of the earth. The elementary knowledge of the physical properties of the common rock forming minerals. Introduction to the major group of rocks, mode of origin, classification and properties.

Unit 2. Geomorphology and Structural Geology: Fundamental concepts of study of landforms. Weathering and soil formation. Elementary idea of the geological work of glacier, river, sea waves and wind and their engineering significance. Deformation of the rocks. Dip, strike and structural features including fold, fault, joint and unconformity and their engineering significance.

Unit 3. Stratigraphy and Hydrogeology: Geological time scale. Fundamentals of stratigraphy. Physiographic and geotectonic divisions of India. Distribution of rocks of different ages in India.

Concepts of porosity and permeability, water table and types of aquifers. Occurrence and vertical distribution of water in soil and rocks.

Unit 4. Earthquake, Mass Movements and Site Investigation: Earthquake, causes, types, intensity and magnitude. Engineering designs and precautions. Landslides, stability of hill slopes and road cuttings. Factors in site selection, alignment and construction of dam, reservoir, bridge and tunnel.

Unit 5. Geotechnical properties of Rocks and Rock Masses: Rocks as construction material. Common tests, occurrence and distribution of the building stones, road and rail ballast in India.

Engineering properties and geomechanical classification of rock mass.

Text /Reference Books:

1. Prabin Singh, "Engineering and General Geology", Kataria Pubs., Delhi, India.
2. P.K., Mukherjee, "A Text Book of Geology", World Press, Calcutta, India.
3. M.C. Kesavalu, "Text Book of Engineering Geology", CBS Pubs., New Delhi, New Delhi.
4. P.D., Krynine and W.R. Judd, "Principles of Engineering Geology and Geo techniques", CBS Pubs. New Delhi.

BIS Codes:

5. IS : 1125, "Determination of weathering of natural building stones" BIS, Govt. of India.
6. IS : 1126, Determination of durability of natural building stones. BIS, Govt. of India
7. IS : 7422, Part I to V (1974), Symbols and abbreviations for use in Geological maps, sections, subsurface exploratory logs. BIS, Govt. of India.
8. IS : 1893,(1984), Criteria for earthquake resistance design. BIS, Govt. of India.

CE – 291 Civil Engineering Materials Lab.

Course Category : DC

L - T -P : 0 - 0 - 3

Credit : 1.5

List of experiments:

Tests on Cement:

1. Normal Consistency
2. Setting time and soundness
3. Compressive Strength
4. Tensile Strength

Test on fresh Concrete:

7. Effect of Water-Cement ratio
8. Slump and Compaction Factor

Structural Element testing:

9. Test on RC beams.

Tests on Aggregates:

5. Fineness Modulus
6. Bulking and Silt content

CE-292 Fluid Mechanics Lab

Course Category: DC L - T - P : 0 - 0 - 3 Credit :1.5

List of Experiments:

1. Flow over weirs and notches
2. Verification of Bernoulli's Theorem
7. Discharge through an Orifice
8. Centre of Pressure
9. Impact of Liquid jets
10. Head losses through sudden contraction and enlargement

CE-293N Engg. Geology Lab

Course Category: ESAL - T - P : 0 - 0 - 2 Credit :1.0

List of experiments:

Part A: Topographic and Geological Maps

1. Contours and contour patterns.
2. Understanding topographic maps.
3. Understanding geological / structural maps
4. Drawing of geological sections of structural maps of: (a) Horizontal rocks, (b) Vertical rocks, (c) Inclined rocks, (d) Maps with unconformity, (e) Maps with fold, (f) Maps with fault.

Part B:

1. Identification of common rock forming minerals on the basis of physical properties.
2. Identification of common rocks on the basis of physical properties.

CE – 220 Quantity Survey

Course Category: ESA L - T- P: 3 - 1 - 0 Credits: 4.0

- Unit 1 Building Drawings and Practice: IS guidelines, various notations, key or index plan; Plan, section and elevation of building drawing, Exposure to Auto CAD.
- Unit 2 Planning a complete housing unit: Developing its sectional elevation including stair case and inner details and foundation plan.
- Unit 3 Quantity survey and its requirement: Types and method of estimates, principle, units and rules of measurements, Procedure of estimate, quantities Centre line method, long and short wall method) taking out bill of quantities, Estimates, Analysis of building, Practices used in construction industry.

Unit 4 Analysis of rates and accounting: Principle of analysis of rate; Schedule of Rate, Abstract of cost, Concept and book art of using schedule of rate Book cost indices, Specifications ; Definition and types of specification. Selection of appropriate specification, standard specification drafted by CPWD, Writing detailed specification for various building construction works.

Unit 5 Elements of Contract, Tender, types, preparation of tender document, intricacies of tender, law of contract, contract document, contract for Civil Engineering and Architectural services

Books

(1) Civill Engg contract and estimates by B.S.Patil, Orient Longman

(2) Hand Book of Construction Management by P.K.Joy, Orient Longman

(3) Text and document published by various professional bodies and CED like CPWD

IV Semester

CE – 216 Structural Mechanics

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

Unit 1 Analysis of statically determinate trusses; Stability of dams, retaining walls and chimneys; Stress analysis of thin, thick and compound cylinder

Unit 2 Generalized state of stress and strain: Stress and strain tensor, Yield criteria and theories of failure; Tresca, Von-Mises, Hill criteria, Heigh-westerguard's stress space.

Unit 3 Deflection of beams; Load deflection relationship of beam, Deflection calculation by double integration, moment area and conjugate beam methods.

Unit 4 Energy methods; Strain energy, elastic, complementary and total strain energy, Strain energy of axially loaded bar, Beam in bending, shear and torsion; General energy theorems, Castigliano's theorem, Maxwell Bettie's reciprocal theorem; Virtual work and unit load method for deflection, Application to problems of beams and frames.

Unit 5 Structural stability; Stability of columns, Euler's formula, end conditions and effective length factor, Columns with eccentric and lateral load.

Text/Reference books

1. Norris, C.H. and Wilber, J. B. and Utku, S. "Elementary Structural Analysis" Mc Graw Hill, Tokyo, Japan.
1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Kazmi, S. M. A., 'Solid Mechanics" TMH, Delhi, India.

CE – 217 Construction Practice

Course Category : DC

L - T -P : 3 - 1 - 0

Credit : 4

Unit 1 Building planning, site selection, orientation, principles of planning the building, open air space, requirement of parts of buildings, lighting and ventilation, requirements of various rooms, Building bye laws.

- Unit 2** Components of building and their purpose and types; foundations, walls, columns, roofs, doors, windows; Bands and openings in the buildings - seismic requirements; Vertical transport in structures; Building finishes; Basic design of foundation of buildings, Terms used in brick masonry, Bond and types of mortars.
- Unit 3** Excavation, dewatering, shoring, underpinning and scaffolding, drilling, blasting, well sinking and pile driving, cofferdams, form work-fabrication and use. Construction techniques for special structures such as high-rise buildings, road construction, dams, bridges, offshore platforms.
- Unit 4** Damp proofing; causes and effect of dampness, material and method of damp proofing; Termite proofing, pre and post construction treatment; Thermal insulation, methods of thermal insulation, thermal insulation of roofs, exposed walls; Doors and windows, Stair case; parts and type of stairs, dimensioning of stair case.
- Unit 5** Fire protection- fire hazards, characteristics of fire-resisting materials and common building materials; Cracks in walls, floors and ceilings-causes and repairs techniques; Routine maintenance of building and structures.

Text / Reference Books

1. Eldridge, H. J. "Construction Defects in Buildings", HMSO, BKJT Printers Ltd., London, UK.
2. Sing, G. "Building Construction Engineering".

CE – 218 Surveying - I

Course Category : DC

L - T -P : 3 - 1 - 0

Credit : 4

Unit –I

Introduction to conventional methods of surveying, chain survey, compass survey and plane table survey. Numerical examples.

Unit-II

Levelling; definition, instruments, methods of levelling, theory of direct levelling, spirit levelling, differential levelling, curvature and refraction, reciprocal levelling, profile levelling, cross-sectioning,, Barometric levelling,; Sensitiveness of bubble tube, permanent adjustment of level. Trigonometrical levelling, axis signal correction. Determination of difference in elevations using single and reciprocal observations.

Unit-III

Theodolite and traverse surveying; essential parts of transit theodolite, temporary and permanent adjustment of transit theodolite; Measurement of horizontal and vertical angles; Methods of traversing, closing error, balancing of traverse, traverse table, omitted measurements, Tachometry, stadia system, influence of staff tilt, anallatic lens, tangential and subtense systems

Unit-IV

Triangulation, classification of triangulation system, triangulation figures, signals and towers, phase of signal inter visibility and height of stations, base line measurement, corrections to measured length; Measurement of horizontal angles; satellite stations, reduction to center.

Introduction to Hydrographic surveying, shoreline survey; Sounding, methods of locating soundings, reduction of sounding, discharge measurement.

Unit-V

Curves, simple, compound, reverse, transition and vertical curves.

Text Book

1. Kanetkar, T. P., "Surveying and Levelling" Vol. I and II, Pune Vidyarthi Griha Prakashan, Pune, India

Reference Books

1. Punmia, B. C., "Surveying" Vol. I and II, Laxmi Publications, Delhi, India.
2. Clark and David, "Plane and Geodetic Surveying" Vol. I and II, Constable and Company Ltd., U.K.
3. Norman, T. "Surveying" Edward Arnold, U.K.

CE – 294 Structural Mecanics Lab.

Course Category : DC L - T -P : 0 - 0 - 3 Credit : 1.5

List of experiments:

1. Determination of Impact value
2. Determination of Elastic constants and plotting load-deflection curve under transverse loading.
3. Buckling of Columns and test on long columns with different end conditions.
4. Verification of bending moment in Beams
5. Torsion of circular shafts, torque-twist behaviour
6. Determination of Brinnel Hardness Number (BHN)

CE – 295 Surveying Lab. – I

Course Category : DC L - T -P : 0 - 0 – 3 Credit : 1.5

List of the Experiments:

1. Chain Surveying; offset measurement
2. Compass Surveying
3. Plane tabling by radiation method
4. Plane tabling by intersection method
5. Solution of two point problem; resection method
6. Solution of three point problem; resection method
7. Differential leveling I
8. Differential leveling II
9. Longitudinal sectioning
10. Cross sectioning
11. Contouring by indirect method
12. Study of transit theodolite
13. Measurement of horizontal and vertical angles with a theodolite.

CE – 296N Engg. Geology Camp

Course Category : DC Credit : 1.0

V Semester

CE – 311 Design of Concrete Structures – I

Course Category: ESA L - T- P: 3 - 1 - 0 Credits: 4.0

- Unit 1** Load and stresses, load combinations, Working stress and limit state approach. Analysis and design of sections in bending – working stress and limit state method, Rectangular and T-sections, Beams with reinforcement in compression, One-way slab.
- Unit 2** Design for shear and bond, Mechanism of shear and bond failure, Design of shear using limit state concept, Development length of bars; Design of sections in torsion.
- Unit 3** Design of two-way slabs, Rankines-Grashoff and I.S. code method; Design of flat slab – direct method; Circular slab; Slab type staircase, Placement of reinforcement in slabs; Voided slab.
- Unit 4** Design of compression members, Short column, Columns with uni-axial and bi-axial bending; Long columns, use of design charts.
- Unit 5** Design of foundation; Wall footing, Isolated and combined footing for columns.

Text Book

1. Jain, A. K. “Reinforced concrete- limit State Design” NCB, Roorkee, India.

Reference Books

1. Karve and Shah “Limit State Theory and Design of Reinforced Concrete” VGP, Pune, India.
2. Pillai and Menon “Reinforced Concrete Design”, TMH, New delhi, India.
3. Verghese, P. C. “Advanced Reinforced Concrete Design” PHI, Delhi, India
4. Winter, G. “Design of Concrete Structures” Mc Graw Hill, Tokyo, Japan.
5. Evans and Cook “Reinforced and Pre- stressed Concrete” TN, London, U.K.

Selected B. I .S Codes

1. I. S.:456-2000-Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi, India.
2. I. S.:875 -1987(Part I & II)-Code of Practice for Design Loads(other than earthquake) for Building and Structures, BIS, New Delhi, India.
3. I.S.:1893-1984-Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi, India.
4. I.S.:4326-1993-Code of Practice for Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi, India.
5. I.S.:13920- Ductile detailing of reinforced Concrete Structures subjected to Seismic forces, BIS, New Delhi, India.
6. S.P.:16 -Design Aids for Reinforced Concrete to IS:456, BIS, New Delhi, India.
7. S.P.:24 -Explanatory Hand Book of I.S. Code for Plain and Reinforced Concrete, BIS, New Delhi, India.
8. S.P.:34 - Hand Book of Concrete Reinforcement and Detailing, BIS, New Delhi, India.

CE – 312 Soil Mechanics

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

- Unit 1** Soil Properties: Preliminary definitions, phase diagram, interrelationship. Sieve and hydrometer analysis, Atterberg's limit. Classification systems – IS, MIT and Unified classification systems of soil. Soil structure. Compaction of soil – Theory of compaction, laboratory compaction tests, optimum moisture content and zero air void line. Field methods and compaction control.
- Unit 2** Soil water, Permeability: Soil water, effective and neutral pressures. Darcy's law, factors affecting permeability. Laboratory determination of permeability. Permeability of stratified soils. Quick sand conditions and liquefaction of soil.
- Unit 3** Soil stresses: Stresses in soil mass due to surface loading. Boussinesq and Westergaard's formula for point load. Vertical pressure under various uniformly loaded area. Pressure bulb. Newmark's influence chart, approximate methods.
- Unit 4** Compressibility and Consolidation: Virgin compression curve and definition of the terms. Terzaghi's one dimensional consolidation theory. Laboratory consolidation test, height of solids and change in voids ratio methods. Determination of coefficient of consolidation by log of time fitting and square root of time fitting methods. Consolidation settlement.
- Unit 5** Shear Strength of soil: State of stress at a point, Mohr's stress circle. Shear strength of soil. Mohr and Mohr-Coulomb failure envelop. Direct, Triaxial, Unconfined and Vane shear tests, principles of drained and undrained tests, stress path.

Text / Reference Books

1. Gopal Ranjan, "Basic and Applied Soil Mechanics", New Age International (P) Ltd, New Delhi.
2. Alam Singh, "Soil Engineering in Theory and Practice", Asia Publishing House, New Delhi.
3. V.N.S.Murty, "Soil Mechanics and Foundation Engineering", Sai Kripa Technical Consultants, Bangalore.
4. Som and Das, "Theory and Practice of Foundation Design", PHI, Delhi, India.

CE – 314 Surveying - II

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

- Unit 1** Elementary photogrammetry; terrestrial and aerial photogrammetry, aerial photographs, scale of vertical photographs; Stereoscopy and parallax; Relief displacement; Flight planning, plotting instruments; Hydrographic surveying, shoreline survey; Sounding, methods of locating soundings, reduction of sounding, discharge measurement.
- Unit 2** Triangulation, classification of triangulation system, triangulation figures, signals and towers, phase of signal inter visibility and height of stations, base line measurement, use of EDM instruments, corrections to measured length; Measurement of horizontal angles; satellite stations, reduction to center; Trigonometrical levelling.
- Unit 3** Curves, simple, compound, reverse, transition and vertical curves.
- Unit 4** Errors and adjustment of observation; laws of accidental errors, probability curve, principle of least squares, Laws of weights, probable and standard error, distribution of error to field measurements, determination of most probable values, methods of normal equations and correlates, station and figure adjustment.

Unit 5 Field astronomy, definition of astronomical terms, formulae of spherical trigonometry, astronomical triangles, co-ordinate systems, measurement of time, determination of azimuth and latitude.

Text Book

2. Kanetkar, T. P., "Surveying and Levelling" Vol. I and II, Pune Vidyarthi Griha Prakashan, Pune, India

Reference Books

4. Punmia, B. C., "Surveying" Vol. I and II, Laxmi Publications, Delhi, India.
5. Clark and David, "Plane and Geodetic Surveying" Vol. I and II, Constable and Company Ltd., U.K.
6. Norman, T. "Surveying" Edward Arnold, U.K.

CE – 391 Soil Mechanics Lab.

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

List of Experiments:

1. Determination of the specific gravity of the soil by Pycnometer
2. Determination of the specific gravity of the soil by Density bottle.
3. Gradation of soil by sieve analysis.
4. Determination of liquid and plastic limit of the soil by Cassagrand's apparatus.
5. Determination of the permeability of the soil by falling head method.
6. Determination of the permeability of the soil by constant head test method.
7. Determination of the field density by core cutter method.
8. Determination of the permeability of the soil by sand replacement method.
9. Determination of maximum dry density and optimum moisture content by Proctor's compaction test.
10. Hydrometer analysis.
11. Direct Shear test.
12. Triaxial compression test.

CE – 393 Survey Lab. II

Course Category : DC

L - T -P : 0 - 0 - 3

Credit : 1.5

List of the Experiments:

1. Observation of vertical and horizontal angles.
2. Determination of stadia constants.
3. Determination of gradient of a line by stadia method of tachometry.
4. Determination of gradient of a line by tangential method of tachometry.
5. Use of subtense bar.
6. Analytical solution of three point problem.
7. Determination of the length of the omitted portion of a base line.
8. Determination of the height of an object by trigonometrical observations from two stations lying in the same vertical plane as the object.
9. Determination of the height of an object by trigonometrical observations from two stations not lying in the same vertical plane as the object.
10. Setting out a simple curve by Rankine's method.
11. Setting out a curve by two-theodolite method.

12. Determination of the azimuth of a line by extra meridian observation of Sun.
13. Depth perception from stereo pair of photographs and use of sketch master.
14. Electro optic distance measurement (EDM).
15. Use of microptic instruments.

CE – 394 Survey Camp

Course Category : DC Credit : 1.0

Based on understanding towards the field problem a survey camp should be arranged during the V semester.

VI Semester

CE – 315 Structural Analysis - I

Course Category: ESA L - T- P: 3 - 1 - 0 Credits: 4.0

- Unit 1** Indeterminate structures; Static and kinematic indeterminacy, Analysis of indeterminate beams, moment area method, Effect of yielding of supports, Consistent deformation method, Three moment theorem.
- Unit 2** Displacement methods; Slope deflection method, Moment distribution method, Application to continuous beam, non-sway and sway frames.
- Unit 3** Analysis of indeterminate pin jointed perfect and redundant frames.
- Unit 4** Three hinged, two hinged and fixed arches, analysis by energy and force method.
- Unit 5** Analysis of cables and suspension bridges, Two hinged and three hinged stiffening girders

Text Books

1. Reddy, C. S., “Basic Structural Analysis” TMH, Delhi, India.

Reference Books

1. Vazirani and Ratwani, “ Basic structural analysis” Khanna, Delhi, India.
2. Punmia, B. C., “Strength of Material and Mechanics of Structures” Vol. I&II, Laxmi pubs. India.
3. Gupta, Pandit and Gupta, “Theory of structures Vol.” I &II

CE – 317 Transportation Engineering

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

- Unit 1** Highway Planning and Geometric Design: Highway development and planning in India, Pavement Characteristics, Sight distances, Design of horizontal and vertical alignment.
- Unit 2** Highway Material and Construction: Properties of sub-grade and pavement component material, tests on stone aggregate and bituminous materials. Highway construction – WBM, bituminous and cement concrete pavement.
- Unit 3** Pavement Design: Design factors for flexible and rigid pavements. Group Index and CBR methods for flexible pavement design. Analysis of wheel load stresses in rigid pavement. Westergaard's method for design of rigid pavement
- Unit 4** Railway Engineering: Gauges, creep and wear of rails. Sleepers, station and yards, points and crossing. Tractive resistance.
- Unit 5** Airport Engineering: Airport planning and Airport layout- runway orientation, Wind Rose diagram, basic runway length, corrections for runway length. Airport classification, geometric design. Airport capacity, Aircraft parking systems.

Text / Reference Books

S. K. Khanna and Justo, C. E. G., "Highway Engineering", Nemi Chand & Bros. Roorkee, India.

K.F. Antia, "Railway Engineering", New Book Company, Bombay, India.

S. K. Khanna & M. G. Arora, " Airport Planning and Design" , Nemi Chand & Bros. Roorkee, India.

Saxena and Arora, "A Text Book of Railway Engineering", Dhanpat Rai and Sons, Delhi, India.

S. P. Bindra, "A Course in Highway Engineering", Dhanpat Rai and Sons, Delhi, India.

J.S., Mundry, "Railway Track Engineering", Tata Mc Graw-Hill, New Delhi, India.

CE – 318 Design of Steel Structures

Course Category: ESA

L - T- P: 3 - 1 - 0

Credits: 4.0

- Unit 1** Properties of materials; loads and stresses, Design of semi-rigid, rigid and moment resistant connections; Built up sections
- Unit 2** Design of tension members subjected to axial tension and bending, splicing of tension member, Design of compression members, Beam-column connections, Design of columns and their bases
- Unit 3** Design of flexural members and Plate girder; loads, specification and design
- Unit 4** Industrial buildings; loads, design of purlins, trusses, bracings; gantry girders

Unit 5 Introduction to Plastic analysis; Simple cases of beams and frames

Text Book

1. Kazmi, S. M. A. and Jindal, R.S. "Design of Steel Structures" PHI, New Delhi, India.

Reference Books

- Arya and Ajmani "Design of Steel Structures", NCB, Roorkee, India.
Ramamrutham "Design of Steel Structures" Dhanpat Rai, Delhi, India.

Selected B. I .S Codes

1. I. S.:800-2000-Code of Practice for General Construction in Steel, BIS, New Delhi, India.
2. I. S. Steel Tables containing Properties of Steel sections, BIS, New Delhi, India.
3. I. S.:802-1992-Code of Practice for use of Structural Steel in Transmission Line Towers", BIS, New Delhi, India

CE – 395 Structures Lab.

Course Category : DC L - T -P : 0 - 0 - 3 Credit : 1.5

List of experiments:

1. Determination of shear centre for Channel section.
2. Study of stress in pin-jointed frames
3. Verification of theorem of Compatibility & Comparison of deflections of a perfect and redundant truss.
4. Study of Stress- Strain behaviour of M.S. bar under axial tension and determination of elastic modulus.
5. Load-Deflection test on simply supported MS I-Section under flexure.
6. Assessment of strength of concrete cubes using Non-destructive tests.

CE – 397N Transportation Engineering Lab.

Course Category : DC L - T -P : 0 - 0 - 2 Credit : 1.0

List of Experiments:

Determination of hardness of stone by Los Angles abrasion test.

Determination of toughness of stone by Impact test.

C. B. R. test.

Specific Gravity and Water Absorption of stone Aggregate.

Flakiness Index test

Elongation Index test

Penetration needle test on Bitumen.

Deval Attrition test.

Crushing strength test

VII Semester

CE – 411 Design of Concrete Structures – II

Course Category: ESA L - T- P: 3 - 1 - 0 Credits: 4.0

- Unit 1** Design of continuous beams and building frames, Moment redistribution, Estimation of wind and seismic loads, Desirable features of earthquake resistant construction, Detailing for earthquake resistant construction – ductility criteria
- Unit 2** Water tank and staging; Introduction, Design criteria, Design of rectangular and circular water tank, Design of Intze tank, Staging for overhead tank
- Unit 3** Introduction to bridge engineering, Investigation for bridges, IRC loadings, Design of slab culvert; Design of Masonry walls and columns
- Unit 4** Pre-stressed concrete, Introduction, pre-stressing system, losses in pre-stress, Design of simple span girders, Design of end block
- Unit 5** Design of staircases; Design of cantilever and counter-forte type retaining wall

Text Book

1. Jain, A. K. “Reinforced concrete- limit State Design” NCB, Roorkee, India.
2. Raju, N.K. “Pre-Stressed Concrete” TMH, Delhi, India.

Reference Books

1. Karve and Shah “Limit State Theory and Design of reinforced Concrete” VGP, Pune, India.
2. Pillai and Menon “Reinforced Concrete Design” TMH, New delhi, India..
3. Verghese, P. C. “Advanced Reinforced Concrete Design” PHI, Delhi, India.
4. Winter, G. “Design of Concrete Structures” Mc Graw Hill, Tokyo, Japan.
5. Evans and Cook “Reinforced and Pre- stressed Concrete” TN, London, U.K.
6. Lin, T. H. and Burns, H. N., “Design of Pre-Stressed Concrete Structures”, Wiley, Canada.

Selected B. I. S Codes

1. I. S.:456-2000-Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi, India.
2. I. S.:875 -1987(Part I & II)-Code of Practice for Design Loads(other than earthquake) for Building and Structures, BIS, New Delhi, India.
3. I.S.:1893-1984-Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi, India.
4. I.S.:4326-1993-Code of Practice for Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi, India.
5. I.S.:13920- Ductile detailing of reinforced Concrete Structures subjected to Seismic forces, BIS, New Delhi, India.
6. S.P.:16 -Design Aids for Reinforced Concrete to IS:456, BIS, New Delhi, India.
7. S.P.:24 -Explanatory Hand Book of I.S. Code for Plain and Reinforced Concrete, BIS, New Delhi, India.
8. S.P.:34 - Hand Book of Concrete Reinforcement and Detailing, BIS, New Delhi, India.
9. I.S.:1343-1980-Code of Practice for Pre-Stressed Concrete, BIS, New Delhi, India.

CE – 413 Foundation Engineering

Course Category: ESA L - T- P: 3 - 1 - 0 Credits: 4.0

- Unit 1.** Earth Pressures and Retaining, Structures; Active, Passive and Pressure at rest, Rankine's and Coulomb's Theories; Influence of Surcharge, Water Table and Wall Friction; Rebhann's and Culmann's Graphical Constructions, Simplified Procedure for Design of Sheet Pile Walls and Anchored Bulk Heads.
- Unit 2.** Stability of Slopes: Infinite Slope and their Stability. Total and Effective Stress analysis. Concepts of Factors of Safety, Method of Slices, Friction Circle and Bishop's simplified Methods. Taylor's Stability Number. Effect of Steady Seepage; Sudden Draw down and Submergence.
- Unit 3.** Shallow Foundations: Definitions, Bearing Capacity of Footings; Terzaghi, Mayerhof and Skempton's analysis. Effect of Rising and Lowering of Water Table on Bearing Capacity; Settlement: Permissible, Total and Differential Settlements as per IS Code. Plate Load test, Standard Penetration and Cone Penetration Tests for Determining Allowable Bearing Pressure.
- Unit 4.** Deep foundations and site investigation: Introduction to Pile Foundation, Bearing and Friction Piles, Bearing Capacity of Single Pile and Pile Groups. Engineering News' and Hiley's formulae. Boring and sampling Techniques and sampling disturbances.
- Unit 5.** Machine Foundation: Design Criteria, Free and Forced Vibrations for Single Degree of Freedom systems, Undamped and Damped Case, Types of Machine Foundations.

Text / Reference Books

1. Kaniraj, S.R., "Design Aids in Soil Mechanics and Foundation Engineering", Tata Mc Graw Hill New Delhi, India.
2. Khan I.H., "A Text Book of Geotechnical Engineering", Prentice-Hall of India Pvt. Ltd., Delhi, India.
3. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers, New Delhi, India.
4. Richart, F.E, Jr., and R.D Woods, "Vibrations of Soils and Foundations", Prentice Hall, N.J, USA.

CE – 490 Project (Contd. to VIII Sem)

Course Category : DC L - T -P : 1 - 2 - 0 Credit : 3*

Any suitable topic with the aim of providing training in the areas of analysis, design, development of new ideas in civil engineering, including collection of data, making drawings, cost estimate and writing report.

(* Incomplete Grade, I, to be assigned to the students, which will be converted to regular grade at VIII semester level)

CE – 491N Concrete Design Practice

Course Category : DC L - T -P : 0 - 0 - 2 Credit : 1.0

List of Designs:

1. Designing and detailing of Beams/ slabs/ column/ foundation.
2. Designing and detailing of Slab Culvert
3. Designing and detailing Rectangular water tank/ Intz tank.

CE – 492N Steel Design Practice

Course Category : DC L - T -P : 0 - 0 - 2 Credit : 1.0

List of Designs:

1. Designing and detailing with connection, Built up Columns and their bases.
2. Designing and detailing of beams, plate girder, gantry girder.
3. Designing and computer detailing of industrial buildings
4. Design and detailing of steel staging for water tank/ column base.

CE – 498N Vocational Training

Course Category : DC Duration: 1 month Credit : 1.5

VIII Semester**CE – 410 Construction Management**

Course Category: ESA L - T- P: 3 - 1 - 0 Credits: 4.0

- Unit 1** Financial analysis; Cost of project, means of finances, planning the means of finances, depreciation, PWD accounts
- Unit 2** Resource Management; Basic concepts, labour requirements, labour productivity, site productivity, non-productive activities, Equipment management, Material management
- Unit 3** Factors affecting the selection of construction equipments, brief description of bulldozers, scrapers, concrete mixers and sprinklers
- Unit 4** Introduction to CPM, critical path, study of various floats, construction of networks, event, activity time computations, project time evaluation.
- Unit 5** Cost control for normal and crash time networks, probability of completion of project based on PERT time estimates; Linear programming- Simplex method

Text / Reference Books

1. Antil and Woodhead, "Critical Path Methods in Construction Practice", Jhon Wiley, NY, USA.
2. Purifoy, "Construction Planning, equipments and Methods", Mc Graw Hill, Tokyo, Japan.
3. Sengupta, B, and Guha, H., "Construction Management and Planning", TMH, New Delhi, India.

DEPARTMENTAL ELECTIVES

CE – 421 Concrete Technology

Course Category : DE I L - T -P : 3 - 1 - 0 Credit : 4

Unit 1 Concrete; Properties of ingredients, tests, Production of concrete, mixing, compaction curing, Properties of fresh concrete; Defects in Concrete, Concrete additives.

Unit 2 Behavior of concrete in tension and compression, shear and bond, Influence of various factors on test results, Time dependent behavior of concrete -creep, shrinkage and fatigue.

Unit 3 Concrete mix design; Proportioning of concrete mixes, basic considerations, cost specifications, factors in the choice of mix proportion, different method of mix design. Quality control, Behavior of concrete in extreme environment; temperature problem in concreting, hot weather, cold weather and under water conditions, Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance

Unit 4 Inspection and testing of concrete- Concrete cracking, types of cracks, causes and remedies Non destructive tests on concrete; Chemical tests on cement and aggregates.

Unit 5 Special concrete; types and specifications, Fibre reinforced and steel Fibre reinforced concrete, Polymer concrete, Use of admixtures; Deterioration of concrete and its prevention Repair and rehabilitation.

Text / Reference Books

1. Neville, A.M., "Properties of Concrete", Longman, India.
2. Neville, A.M., "Concrete Technology", Longman, India.
3. Gambhir, M. L., "Concrete Technology", TMH, New Delhi, India.

CE – 423 Traffic Engineering

Course Category: ESA L - T- P: 3 - 1 - 0 Credits: 4.0

Unit 1. Introduction: Development of Highway, Scope and Function of Transportation and Traffic Engineering. Basic Structure of Transportation Systems, Object of Transport Planning, Drawback of Transport. The Traffic Problem.

Unit 2. Traffic Characteristics: Road User and Vehicular Characteristics, traffic flow characteristics, traffic volume, O & D study, Speed and Delay Study. Accident Studies and Safety, Methods for the Reduction in Accident Rates, The Environmental Effects on Highway Traffic Noise and Pollution.

Unit 3. Traffic Facilities Design: Design of Intersections – Principles of Intersection Design, Rotary Intersections, Grade Separated Intersections. Grade Separation Structures, Design of Parking Facility, Highway Lighting, Design of Highway Lighting System.

Unit 4. Traffic Signals and Vehicle Safety: Traffic Regulations, Controls on Vehicles, Drivers and Flow, One Way Street, Basics of Traffic Control Devices, Traffic Signs, Traffic Signals and their Design, Traffic Islands and Markings.

Unit 5. Traffic and Transportation Planning: Traffic Planning, Urban Transportation Planning Process – Inventories, Trip Generation, Trip Distribution, Traffic Assignment, Plan Preparation and Evaluation, PCU Value for Urban Roads.

Text / Reference Books

1. Matson, T.M., Smith, W.S. and Hurd, F.W., “Traffic Engineering”, McGraw-Hill, NY, U.S.A.
2. Salter, R.J. “Highway Traffic Analysis and Design”. The Macmillan Press Ltd., London, UK.
3. S.K. Khanna and C.E.G. Justo, “Highway Engineering”. Nemi Chand and Bros., Roorkee
4. Subhash C. Saxsena, “A course in Traffic Planning and design”, Dhanpat Rai Sons, Delhi, India.
5. Louis J. Pignatro, “Traffic Engineering Theory and Practice” Printice- Hall, New Jersey, USA.

CE – 430 Structural Analysis - II

Course Category : DE-IV L - T -P : 3 - 1 – 0 Credit : 4

Unit 1 Analysis of building frames; Kani’s method and Approximate methods

Unit 2 Stiffness matrix method; Application to simple problems of beams and frames

Unit 3 Flexibility matrix method; Application to simple problems of beams and frames

Unit 4 Moving loads for determinate beams; Different load cases, Influence lines for forces for determinate beams

Unit 5 Influence lines for pin-jointed trusses; Influence lines for indeterminate beams using Muller Breslau principle. Influence lines for Arches and stiffening girders.

Text Books

1. Wang, C. K., “Elementary Structural Analysis” Mc Graw Hill, New York, USA.

Reference Books

1. Reddy, C. S., “Basic Structural Analysis” TMH, Delhi, India.
2. Levisley, “Matrix Method of structural analysis”, Pergamon, London, U.K.
3. Morice, B.P., “Linear Structural Analysis” Thames and Hudson, London, U. K.
4. Pundit, G. S. and Gupta, S.P., “Structural Analysis – A Matrix Approach” TMH, Delhi, India.

CE – 431 Reliability Analysis of Structures

Course Category : DE-IV L - T - P : 3 - 1 - 0 Credit : 4

Unit 1 Role of reliability in civil engineering; Historical background, random events, random variables, model uncertainty; Common probabilistic models; Important statistical parameters and their estimations, normal, lognormal, extreme value distribution.

Unit 2 Fundamental concept of structural reliability; Derivation of stress-strength interface equation, graphical representation, Cornell reliability index, reliability and failure probability computations for simple linear functions.

Unit 3 Second moment concepts, First order second moment theory, Hasofer-Lind transformation, Linear and non-linear limit state functions, Solution schemes, geometric interpretation of solution scheme, Rackwitz-Fiessler transformation, First order reliability method

Unit 4 Stochastic models for material strength and loads, Reliability assessment of structural component and simple civil engineering structures.

Text Book

1. Ranganathan, R., “Reliability Analysis and Design of Structures” TMH, New Delhi, India

Reference Books

1. Melchers, R. E., “ Structural Reliability Analysis and Prediction” EHL, England
2. Cristenson, P. T. and Baker, M. J., “Structural Reliability Analysis and its Application” Springer, NY, USA.
3. Madsen, H. O., Krenk, S. and Lind, N. C., “Methods of Structural Safety” PHI, New Jersey, USA.

CE – 433 Advanced Highway Engineering

Course Category : DE-V L - T - P : 3 - 1 - 0 Credit : 4

Unit 1 Pavement Design: Design wheel loads, CBR, McLeod and Stabilometer methods for flexible pavement design. Modified Westergaard’s analysis, Bradbury’s work and IRC recommendations for design of rigid pavements.

Unit 2 Hill Roads: General consideration, alignment and geometries of hill roads, Design and construction of hill roads.

Unit 3 Highway Drainage: Importance of highway drainage, surface and sub-surface drainage, construction of roads in water logged areas, Drainage of slopes and erosion control.

Unit 4 Highway Maintenance: Causes and types of pavement failure, maintenance of flexible and rigid pavements, strengthening of existing pavement.

Text / Reference Books

1. G. V. Rao, "Principles of Transportation and Highway Engineering", Tata McGraw-Hill Publishing Company Limited, New Delhi, India.
2. S. K. Khanna and Justo, C. E. G., "Highway Engineering", Nemi Chand & Bros. Roorkee, India.

CE – 434 Bridge Engineering

Course Category : DE-V L - T -P : 3 - 1 - 0 Credit : 4

Unit 1 General; classification, site selection, geometric and hydraulic design consideration, loading standards for highway and railway bridges, general design consideration

Unit 2 Concrete bridges; Introduction, T-beam bridge, balanced cantilever bridge, cable stayed bridge, arch bridge

Unit 3 Steel bridges; Introduction, plate girder bridge, truss bridge, suspension cable bridge, cable stayed bridge

Unit 4 Substructure; design of piers and abutments, pile and well foundation, bearings, seismic design considerations

Text / Reference Books

1. Victor, "Essentials of Bridge Engineering", Oxford, New Delhi, India.
2. Arya and Ajmani, "Design of Steel Structures", Nem Chand, Roorkee, India.

CE – 437 Prestressed Concrete

Course Category : DE-V L - T -P : 3 - 1 - 0 Credit : 4

Unit 1 Pre-stressed concrete, basic concept; pre-stressing material and pre-stressing systems; losses of pre-stress, End anchorage and cable layouts.

Unit 2 Analysis and design of pre-stressed concrete flexure members, simply supported beam and slabs.

Unit 3 Analysis and design for shear, bond and bearing.

Unit 4 Analysis and design of pre-stressed concrete continuous beams.

Unit 5 Analysis and design of pre-stressed concrete compression and tension members.

Text Book / Reference Book

1. Raju, N.K. "Pre-Stressed Concrete" TMH, Delhi, India.
2. Lin, T. H. and Burns, H. N., "Design of Pre-Stressed Concrete Structures", Wiley, Canada.
3. I.S.:1343-1980-Code of Practice for Pre-Stressed Concrete, BIS, New Delhi, India.

CE – 438 Advanced Structural Analysis

Course Category : DE-VI L - T -P : 3 - 1 – 0 Credit : 4

- Unit 1** Elasticity: Introduction, Components of strain and strain, Hooke's law, Plane stress and plane strain, Equations of equilibrium and compatibility, Boundary conditions, Two dimensional problems in rectangular and polar coordinates, Bending of simple and cantilever beams.
- Unit 2** Model Analysis: Structural similitude, Direct and indirect model analysis, Model material and model making, Measurement for forces and deformations
- Unit 3** Introduction to Finite element method for structural analysis; Review of principle of virtual work, Ritz method, Discretization of domain, Basic element shape, Discretization process
- Unit 4** Application of finite element method to one and two- dimensional plane stress strain elements.

Text / Reference Books:

- Timoshenko, S.P. and Goodier, J.N. "Theory of Elasticity", Mc Graw Hill, London, U.K.
Singh, S., "Applied Stress Analysis", Khanna Publisher, New Delhi, India.
3. Sinha, N.C. and Gayen, P.K., "Advanced Theory of Structures", Dhanpat Rai Publications, New Delhi, India.
4. Zienkiewicz, O.C., "The Finite Element Method in Engineering", Mc Graw Hill, London, U.K.
5. Krishnamoorthy, E. V., "Finite Element Analysis and programming" TMH, London, U.K.
6. Tripathi, R., Chandrupatla, A. and Belegundu, D., "Introduction to Finite Element in Engineering", Pearson Education, New Delhi, India.

CE – 439 Industrial Structures

Course Category : DE-VI L - T -P : 3 - 1 – 0 Credit : 4

- Unit 1** Industrial steel building frames: Types of frames, bracing, crane girders and columns, workshop sheds, trussed bents, Pressed steel tank, circular tank
- Unit 2** Transmission and Communication towers: Types and configuration, Analysis and design.
- Unit 3** Chimneys; Loads and stresses in chimney shaft, Earthquake and wind effect, Stresses due to temperature difference, combined effect of loads and temperature, temperature. Design of chimney; Silos and Bunkers; Jassen's theory, Airy's theory, Shallow and deep bins, Rectangular bunkers with slopping bottom, Rectangular bunkers with high side walls; Steel stacks; introduction, force acting on a steel stack, design consideration, design example of stacks.
- Unit 4** Concrete Shell Structures: Folded plate and cylindrical shell structures; Introduction, structural behaviour of long and short shells, beam and arch action, analysis and design of cylindrical shell structures, Analysis and design of folded plates.
- Unit 5** Machine foundations; introduction, machine vibration, structural design of foundation to rotary machines, impact machines, vibration characteristics, design consideration of foundation to impact machine, grillage, pile and raft foundation.

CE - 441 Advanced Foundation Engineering

Course Category : DE-VI L - T - P : 3 - 1 - 0 Credit : 4

- Unit 1.** Foundation in Expansive Soil: Clay Mineralogy, Methods of Foundation in Expansive Soils, Bearing Capacity of single and Multi-under-reamed Pile Foundation. IS: 2911(Part III)
- Unit 2.** Shallow Foundation: Hansen's and Vesic's Bearing Capacity theory. IS Code Method for Bearing Capacity. Standard Penetration Test, Cone Penetration Test and Plate Load Test. Effect of Raising and Lowering of Water Table on Bearing Capacity and Settlement. Raft or Mat Foundations. Influence of Inclined and Eccentric Loads.
- Unit 3.** Deep Foundation: Indian Standard for Pile Load Test. Bearing Capacity of Pile Groups in Cohesive and Cohesionless Soils. Shear and Settlement Criteria, Bearing Capacity of Well Foundations.
- Unit 4.** Wave Propagation: Waves in an Infinite, Homogeneous and Isotropic Elastic Medium, Longitudinal Shear and Rayleigh Waves, Elements of Seismic Methods. Direct Arrival Survey, Reflection Survey and Refraction Survey.

Text / Reference Books

1. Shenbaga R.Kaniraj, "Design Aids in Soil Mechanics and Foundation Engineering", Tata McGraw-Hill, New Delhi, India.
2. H.A. Buchholdt, "Structural Dynamic for Engineers", Thomas Telford Publication, New York, USA.
3. Joseph E. Bowles, "Foundation Analysis and Design", The McGraw-Hill Companies, New Delhi, India.
4. T. William Lambe and Robert V. Whitman, "Soil Mechanics", JohnWiley, New York, USA.

CE - 444 Disaster Management

Course Category : DE-VI L - T - P : 3 - 1 - 0 Credit : 4

Understanding of Disasters: Earthquake, flood, cyclone, landslide etc. Preparedness and Mitigation: Disaster mapping, predictability, forecasting and warning, disaster preparedness plans, Land use zoning for disaster management. Reconstruction and rehabilitation: Disaster resistant housing, retrofitting, repair and re-strengthening. Man made disasters: Nuclear, chemical and biological disasters, building fire. Disaster Management and Awareness: Human behaviour and response, community participation and awareness, public awareness programmes.

Advanced Surveying CE-445

Unit-I

Photogrammetry; terrestrial and aerial photogrammetry, aerial photographs, scale of vertical photographs; Stereoscopy and parallax; Relief displacement; Flight planning, plotting instruments.

Unit-II

Field astronomy, definition of astronomical terms, formulae of spherical trigonometry, astronomical triangles, co-ordinate systems, measurement of time, determination of azimuth and latitude.

Unit-III

Remote Sensing, Concepts, applications, instruments used. GIS and its applications.

Unit-IV

Total Station, Concept of EDM, uses of total station

Books

- Kanetkar, T. P., "Surveying and Levelling" Vol. II, Pune Vidyarthi Griha Prakashan, Pune, India
Punmia, B. C., "Surveying" Vol. III, Laxmi Publications, Delhi, India.