राष्ट्रीय प्रौद्योगिकी संस्थान जमशेदपुर
NATIONAL INSTITUTE OF TECHNOLOGY JAMSHEDPUR

An Institution of National importance under MHRD, Government of India
Department of Civil Engineering

2018

CURRICULA AND SYLLABI

B.TECH. (HONS.)

NIT,Jamshedpur

8/6/2018

B.Tech. (Hons.) Course Structure

SEMESTER – III

S.No.	Subject Code	Subject Name	L-T-P	Credits
1.	CE 1301	Engineering Mathematics-III	3-1-0	04
2.	CE 1302	Survey-I	3-0-0	03
3.	CE 1303	Strength of Materials	3-1-0	04
4.	CE 1304	Building Materials and Construction	3-0-0	03
5.	CE 1305	Engineering Geology & Seismology	3-0-0	03
6.	CE 1306	Fluid Mechanics-I	3-0-0	03
7.	CE 1307	Building Materials Lab	0-0-2	01
8.	CE 1308	Building Planning and Drawing	0-0-2	01
9.	CE 1309	Engineering Geology Lab	0-0-2	01
10.	CE 1310	Strength of Materials Lab	0-0-2	01
		TOTAL	**18-2-8**	**24**

SEMESTER – IV

S.No.	Subject Code	Subject Name	L-T-P	Credits
1.	CE 1401	Concrete Technology	3-0-0	03
2.	CE 1402	Survey-II	3-0-0	03
3.	CE 1403	Structural Analysis-I	3-1-0	04
4.	CE 1404	Fluid Mechanics-II	3-1-0	04
5.	CE 1405	Geotechnical Engineering-I	3-1-0	04
6.	CE 1406	Design of Concrete Structures-I	3-1-0	04
7.	CE 1407	Concrete Lab	0-0-2	01
8.	CE 1408	Survey Field Work	0-0-2	01
9.	CE 1409	Fluid Mechanics Lab	0-0-2	01
		TOTAL	**18-4-6**	**25**

SEMESTER – V

S.No.	Subject Code	Subject Name	L-T-P	Credits
1.	CE 1501	Structural Analysis – II	3-1-0	04
2.	CE 1502	Geotechnical Engineering – II	3-1-0	04
3.	CE 1503	Water Resources Engineering	3-1-0	04
4.	CE 1504	Design of Steel Structures	3-1-0	04
5.	CE 1505	Environmental Engineering-I	3-1-0	04
6.	CE 1506	Geotechnical Engineering – I Lab	0-0-2	01
7.	CE 1507	Detailing of structures	0-0-2	01
8.	CE 1508	Environmental Engineering Lab	0-0-2	01
		TOTAL	**15-5-6**	**23**

SEMESTER – VI

S.No.	Subject Code	Subject Name	L-T-P	Credits
1.	CE 1601	Design of Concrete Structure-II	3-1-0	04
2.	CE 1602	Transportation Engineering-I	3-1-0	04
3.	CE 1603	Environmental Engineering-II	3-0-0	04
4.	CE 1604	Estimating & Costing & Valuation	3-0-0	03
5.	CE 16XX	Professional Elective-I	3-0-0	03
6.	CE 1605	Geotechnical Engineering – II Lab	0-0-2	01
7.	CE 1606	CAD LAB.	1-0-2	01
8.	CE 1607	Transportation Engineering Lab	0-0-2	01
		TOTAL	**16-2-6**	**21**

SEMESTER – VII

S.No.	Subject Code	Subject Name	L-T-P	Credits
1.	CE 1701	Structural Dynamics and Earthquake Resistant Design	3-1-0	04
2.	CE 1702	Irrigation Engineering	3-1-0	04
3.	CE 1703	Transportation Engineering-II	3-0-0	03
4.	OE 17XX	Open Elective-I	3-1-0	04
5.	CE 17XX	Professional Elective - II	3-0-0	03
6.	CE 1704	Projects & Industrial Training	0-0-6	04
7.	CE 1705	Computational Method in Civil Engineering	1-0-2	01
		TOTAL	**16-3-8**	**23**

SEMESTER – VIII

S.No.	Subject Code	Subject Name	L-T-P	Credits
1.	CE 1801	Prestress Concrete Design	3-0-0	03
2.	CE 1802	Civil Construction, Planning and Management	3-0-0	03
3.	OE 18XX	Open Elective - II	3-1-0	04
4.	CE 18XX	Professional Elective – III	3-0-0	03
5.	CE 18XX	Professional Elective – IV	3-0-0	03
6.	CE 1803	Projects and Seminar	0-0-10	05
		TOTAL	**15-1-10**	**21**

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Professional Elective – I

S.No.	Subject Code	Subject Name
1	CE 1608	Ground Improvement Techniques
2	CE 1609	Advanced Foundation Design
3	CE 1610	Earth Pressures and Retaining Structures
4	CE 1611	Soil Dynamics and Machine Foundation
5	CE 1612	Traffic Safety and Assessment
6	CE 1613	Transportation System and Planning

Professional Elective – II

S.No.	Subject Code	Subject Name
1	CE 1706	Water Supply Systems
2	CE 1707	Remote Sensing and GIS Applications for Land and Water Resources
3	CE 1708	Hydraulic Structures & Hydro power Engineering
4	CE 1709	Environmental Impact Assessment
5	CE 1710	Computational Intelligence for Hydro Systems
6	CE 1711	Embakment Dam Engineering

Professional Elective – III

S.No.	Subject Code	Subject Name
1	CE 1804	Bridge Engineering
2	CE 1805	Theory of Elasticity
3	CE 1806	Finite Element Method
4	CE 1807	Construction Safety and Fire Engineering
5	CE 1808	Advanced Concrete Design
6	CE 1809	Offshore Structures

Professional Elective – IV

S.No.	Subject Code	Subject Name
1	CE 1810	Port and Harbour Engineering
2	CE 1811	Disaster Management
3	CE 1812	High Rise Structures
4	CE 1813	Solid Waste Management
5	CE 1814	Environmental Pollution and Control
6	CE 1815	Traffic Engineering
7	CE 1816	Rock Engineering

Open Elective-I

S.No.	Subject Code	Subject Name
1	CE 1712	Planning for Sustainable Development
2	CE 1713	Project Management

Open Elective-II

S.No.	Subject Code	Subject Name
1	CE 1817	Rural Technology & Community Development

(Prof. N. Dhang)   (Prof. D. Sen)   (Prof. S. P. Singh)   (Er. Subin Kumar)

(Sri Ashok Kumar)   (Sri S. K. Paswan)   (Dr. Ch. M. S. Rao)   (Dr. S. R. Pandey)

(Dr. A. K. Sinha)   (Dr. V. Kumar)   (Dr. P. Prasad)   (Dr. Sanjay Kumar)

(Sri N. Prakash)   (Dr. A.K. Singh)   (Dr. B. K. Prasad)   (Prof. A. K. Chaudhary)

(Prof. A. K. L. Srivastava)   (Prof. A. K. Khan)   (Prof. M. M. Prasad)   (Dr. R. P. Singh)

B.Tech. (Hons.) Detailed Syllabus

SEMESTER-III

CE 1301 ENGINEERING MATHEMATICS-III (3-1-0)

UNIT I : Ordinary Differential equation and some special functions: Series solution of ordinary differential equations, Legendre's and Bessel's functions and their properties.

UNIT II : Calculus of complex functions: complex integration- line integral, Cauchy's theorem, Cauchy's integral formula, review of power series, Taylor series, Laurent series. Residues, Reside theorem, contour integration

UNIT III : Partial differential equations: homogeneous linear partial differential equation with constant coefficient, non-homogeneous linear partial differential equation, elliptic, parabolic and hyper-parabolic type.

UNIT IV : Application of Partial differential equations, one dimensional wave equation, D Alembert's solution of 1D wave equation, 1D heat flow equation, 2D heat flow.

UNIT V : Probability and statistics, Discrete and continuous random variables, cumulative distribution function, probability mass function, probability density function, mathematical expectation, mean, variance, moment generating function, standard probability models – binomial, Poisson and normal. Sampling distribution: Chi-square and t

Text/ Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreysig
2. Higher Engineering Mathematics by B. S. Grewal
3. Mathematical Statistics by J. N. Kapur& H. C. Saxena

CE 1302 SURVEY – I (3-0-0)

UNIT I

Introduction : Classification of surveys, primary division of Surveying-Principle of working from whole to part -conventional signs. **Chain Surveying**: Instruments - principles of chain surveying- Tie and check line-Chaining and Ranging-obstacles- chaining on sloping ground - Errors in chain Survey- uses of cross staff and optical square. **Compass survey** : Prismatic compass-surveyor's Compass, whole circle system and Quadrantal system-True and magnetic bearing-Dip and Declination- Local attraction-Traversing-Plotting a Traverse Survey -Graphical adjustment of closing error in a closed Traverse.

UNIT II

Plane Table Survey: Instruments and accessories- Advantages and disadvantages of plane tabling - Different methods of plane Tabling-Two point problem-Three point problem - Errors in plane tabling.

UNIT III

Levelling: Definitions of Terms used in Leveling- levelling instruments-Temporary and permanent adjustments -principles of levelling-Simple levelling, Differential levelling-Reduction of levels-Classification of levelling-Profile levelling and cross sectioning - correction for curvature and refraction-Reciprocal levelling- Errors in levelling.

UNIT IV

Contour Survey: Definition-characteristics of Contour- uses of contours- Methods of contouring-Interpolation Contours-uses of Contour map.

UNIT V

Area and volumes: Areas along Boundaries- Mid ordinate rule-Average ordinate rule-Trapezoidal rule-Simpson's rule - Area by Meridian distance method- Area by Double meridian method. Departure and total latitude method-Coordinate method- Computation of volume by Trapezoidal and Prismoidal formule -Mass haul curve.Introduction to advanced surveying Equipments – Total station – GPS – Electronic theodolite.

UNIT VI

Theodolite Surveying: Study of Theodolite - Temporary and permanent adjustments-measurement of horizontal angle- method of repetition and reiteration- measurement of vertical angle – Theodolite traversing by direct observation of Angles and by direct observation of Bearings- Adjustment of a closed Traverse (angular error, bearings and closing error) - Bowditch rule-Transit rule-Gale's traverse Table- Omitted measurements.

Tacheometric Surveying : Instruments used-Stadia System-fixed and movable hair methods-Tacheometric constants- Anallatic lens-Tangential System

Text/ Reference Books:

1. Punmia, B.C, Jain, A. K. and Jain, A. K. (2010). *Surveying*. Vol. I & II, Laxmi Publications
2. Chandra, A. M. (2007). *Higher Surveying*. New Age International Publishers.
3. Ghilani, C. D, and Wolf, P. R. (2012), *Elementary Surveying*. Prentice Hall.
4. Arora, K.R. (2012). *Surveying*. Vol.I and II. Standard Book House.
5. Duggal, S. K. (2010), *Surveying*. Vol. I. Tata Mc Graw Hill Publishing Co Ltd.

CE 1303 STRENGTH OF MATERIALS (3-1-0)

UNIT I : Analysis of Stress and Strain- Uniaxial stress and strain: Stress, Strain, Hooke's Law, Stress-strain curves, Elastic Constants, Strain Energy, Statically Indeterminate problems, Thermal Effects, Impact Loading. Biaxial stress and strain: Stress at a Point, Variation of Stress, Stress Transformation, Analysis of Strain, Strain-displacement relations, Strain transformation, Strain Measurements, Constitutive equations, Principal stresses and strain.

UNIT II : Bending and Shear Stresses- Introduction, Pure Bending, Normal stresses in beams, Combined Bending and Axial Stress, Composite Beams, Shear Stress, Shear Centre, Strain energy in bending.

UNIT III : Torsion: Introduction, Torsion of Circular Shaft, Power Transmitted by a Shaft, Compound Shaft,Tapered Shaft, Strain Energy in Torsion, Combined Bending and Twisting, Torsion of Thin Walled Tubes, Open and Closed Coiled Springs.

UNIT IV : Thin and Thick Cylinders & Spheres- Introduction, Thin Walled Shells, Thick Shells, Compound Cylindrical Shell.

UNIT V : Deflections of Beams- Introduction, Equation of Elastic Curve, Methods for Determining Deflections - Double Integration, Macaulay's Method, Moment-Area Method, Conjugate-beam method, Castigliano's Theorem.

UNIT VI : Columns and Theories of Failure- Introduction, Euler's Theory for Long Columns, Rankine-Gordon Formula, Empirical Formulae, Eccentrically Loaded Columns.

Text/ Reference Books:

1. Strength of Materials, K. K. Shukla, Anuj Jain and Ramesh Pandey, Alpha Science Intl Ltd.
2. Elements of Strength of Materials, S.P. Timoshenko and D.H. Young, East-West Press Pvt. Ltd. Publications.
3. Mechanics of Materials, Pytel and Kiusalaas, Cengage Learning Publications.
4. Mechanics of Materials, Gere and Timosheinko, CBS Publications.
5. Mechanics of Materials, E. P. Popov, Prentics Hall Publications.
6. Strength of Materials, G. H. Ryder, Macmillan India Limited.
7. Strngth of Materials- Pytel and Singer, Harpercollins College division publications.
8. Strength of Materials, Crandal, Dahal and Lardener, Tata Mcgraw Hill Publications.
9. Mechanics of Materials- Riley, Struges and Morris, John Wiley & Sons.

CE 1304 BUILDING MATERIALS AND CONSTRUCTION (3-0-0)

UNIT I : Building stones -Requirement of good building stone- characteristics - testing. Common building stones. Preservation of stones. Clay products: Tiles- Manufacture-Properties-Types-Problems of efflorescence and lime bursting in tiles. Lime: Properties- Classifications - Manufacture -Testing of lime.

UNIT II : Mortar: Types –Properties-Tests on mortar, selection and desirable properties of fine and coarse aggregate for concrete, Gypsum: Forms of gypsum and gypsum plaster, properties of gypsum plaster, building products of gypsum and their uses. Pozzolona: Natural and Artificial fly ash, Surkhi (burnt clay pozzolona), rice husk and ash pozzolona,

UNIT   III: Cavity walls – Partition walls – Types and features. Lintels – Classification and loading, Arches – Classification and construction details- Technical terms. Types of Bonds. Stairs- Technical terms- Classification and Types of stairs. Doors, Windows and Ventilations-Technical terms-Construction details of different types.

UNIT IV : Timber - Defects - Seasoning - Decay - Preservation, Wood based products. Iron and steel - Structural sections - Properties and uses of structural steel – Corrosion- forms and preventive measures. Paints varnishes and distempers, Common constituents, types and desirable properties, Cement paints. Glass - Ingredients, properties types and use in construction. Plastics - classification, advantages of plastics, Mechanical properties and their use in construction. Miscellaneous materials – Asbestos, Insulating Materials - Thermal and sound insulating material desirable properties and type.

UNIT V : Floors and flooring - Types of floors - Types of floor coverings; Roof - Types of roofs - Types and uses of roofing materials.

UNIT VI : Finishing works - Plastering, pointing, painting, white washing, colour washing, distempering ; Damp proofing ant termite treatment.

Text Books/ Reference Books:

1. S. K. DUGGAL, BUILDING MATERIALS, New Age International Publishers.
2. Singh, G. (1996). Building materials.
3. Rangwala, S. C. (1992). Engineering Materials. Charotar Publishing House, Anand.
4. Punmia, B. C. (1999). Building Construction. Laxmi Publications, New Delhi.
5. Rangwala, S. C. (1992). Building Construction. Charotar Publishing House, Anand.
6. Huntington, W. C. (1959). Building Construction. John Wiley, New York.

CE 1305 ENGINEERING GEOLOGY AND SEISMOLOGY (3-0-0)

UNIT I: Introduction: Definition - branches of geology -scope of geology – geology in civil engineering-Geological time scale.

Physical Geology: Rock weathering and soils - physical weathering - chemical weathering - climate and soil formation - classification of soil - soil erosion and its control. *Wind* - Wind erosion - Wind transportation - Wind deposition.

Rivers - erosion - transportation - deposition - river meandering - types of rivers - drainage patterns.-*Oceans* – sea erosion - transportation - deposition – coastal protection.

UNIT II : Mineralogy: Definition of minerals - physical properties – Study of physical properties of the following minerals - quartz, Telspar, Muscovite, Biotite, Kyanite, Serpentine.

Petrology : Classification, texture and structures of Igneous , Sedimentary and Metamorphic rocks- factors & kinds of metamorphism – Engineering properties of rocks- Description, engineering properties and uses of the following rocks – Granite , Gabbro, Basalt, Limestone, Shale, Laterite, Quartzite, Marble.

Structural Geology: Attitude of beds, study of structures –folds, faults, fractures and joints – classification, recognition in the field, relevance to civil engineering.

UNIT III : Geological Investigation : Objectives – Methods of investigation – Surface investigation – Sub - surface explorations –Geophysical Methods

Engineering Geology : Geological conditions necessary for design and construction of dam & reservoirs, tunnels, buildings & road cuttings – Landslides –definition, classification, causes and their corrections.

UNIT IV : Seismology : Internal structures of the earth – M-discontinuity – sources of seismic activity - Continental Draift - Plate tectonics –fault movement – Reservoir associated earthquakes – Elastic Rebound Theory - seismic waves – Terminology – Intensity and Magnitude of Earthquake – Energy Released during on earthquake – Locating Epicentre and Focus – Recording of an earthquake – Seismograph – working Principle and Sensitivity of a

Seismographs – classification of earth quakes - based on depth of focus , magnitude, cause of origin –effects of earthquakes – Primary effects – Secondary effects - Distribution of earth quakes –Seismic History of India Seismic Zones of India – Tsunami – Introduction – Tsunami velocity – Velocity in deep ocean – Velocity in shallow water – wavelength of tsunami wave – Drawdown and Run up of a tsunami – inundates of Tsunami waves.

Text Books/ Reference Books:

1. Singh, P. A text book of Engineering and General Geology. Katson Publishers, Ludhiana.
2. Waltham,.T. Foundations of Engineering Geology. Spon Press, London.
3. Blyth, F. G. H. and de Frieitis, M. H. Geology for Engineering
4. Judo, W. R. Principles of Engineering Geology and Geotechnics. McGraw Hill.
5. Mukerjee, P. K. A text book of geology. World Press Ltd., Calcutta
6. S. K. DUGGAL, H. K. PANDEY, N. R. RAWAL, Engineering Geology, Mc Graw Hill Publication.

CE 1306 FLUID MECHANICS-I (3-0-0)

UNIT I : Introduction to Fluid Mechanics-Fluid and continuum, Physical properties of fluids, Types of fluid flows, Rheology of fluids. 2(L)

UNIT II : Fluid Statics and Kinematics-Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis. Kinematics of Fluid flow: steadiness, uniformity, rotational and irrotational flows, streamline, streakline, pathline, continuity equation, stream function and velocity potential, circulation, applications of potential flow. 8(L)

UNIT III : Dynamics of Fluid Flow and Dimensional Analysis-Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications, momentum equation and its application to pipe bends. Dimensional Analysis, Buckingham's Pi theorem, important dimensionless numbers and their physical significance, geometric, kinematic and dynamic similarity, model studies, Hydraulic similitude. 8(L)

UNIT IV : Laminar and Turbulent Flows- Equation of motion for laminar flow through pipes, Stokes law, transition from laminar to turbulent flow, types of turbulent flow, isotropic and homogenous turbulence, scale and intensity of turbulence, eddy viscosity, Prandtl's mixing length theory, velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer (rigid theory), three reservoir problems and pipe network. 10(L)

UNIT V : Hydrodynamic Boundary Layer- Introduction with a historical background, boundary layer, displacement and momentum thickness, boundary layer over a flat plate, Prandtl boundary layer equation, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control, drag and lift, drag on a sphere, a 2D cylinder and an aerofoil, Magnus effect. 8(L)

UNIT VI : Measurement Techniques- Flow measurement by Pitot tube, orifice, Venturi, nozzle, and bend meter, rotameter, notches and weirs, hot-wire anemometer, LDV and PIV, Turbine flowmeter, Vortex shedding flowmeter, magnetic flowmeter, Doppler Ultrasonic flowmeter, Coriolis flowmeter etc. 4(L)

Text/ Reference Books:

1. Fox, R.W., McDonald, A.T., Introduction to Fluid Mechanics, 7th edition, Wiley India.
2. Ojha, C.S.P., Berndtsson, R., Chandramouli, P.N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.
3. Majumdar, B., Fluid Mechanics with Laboratory Manual, PHI Learning, New Delhi.
4. Som, S.K. and Biswas G, Introduction of Fluid Mechanics & Fluid Machines, TMH, New Delhi.
5. Mohanty, A.K., Fluid Mechanics, PHI Learning, New Delhi.
6. Shames, I.H., Mechanics of Fluids, McGraw Hill, International Students Edition.
7. Agarwal, S.K., Fluid Mechanics and Machinery, TMH, New Delhi.
8. Rathakrishnan E., Instrumentation, Measurements and Experiments in Fluids, CRC Press, New York.
9. Garde, R.J., Fluid Mechanics through Problems, New Age International Pvt. Ltd, New Delhi.

CE 1307 BUILDING MATERIALS LAB (0-0-2)

Experiment 1: (a) To determine the specific gravity of cement using lechatelier flask and the fineness by sieve analysis.
(b) To determine the normal consistency and setting times.
Experiment 2: (a) To assess the soundness of Cement using Le-chatelier appartus.
(b) To determine the compressive strength of cement.
Experiment 3: To determine the specific gravity, bulk density and water absorption of Fine aggregates.

Experiment 4: To determine the specific gravity, bulk density and water absorption of Coarse aggregates.

Experiment 5: To study the phenomenon of bulking of sand.

Experiment 6: To draw the grading curves for fine and coarse aggregates and hence to determine their fineness moduli.

Experiment 7: To determine the crushing value, impact value and ten percent fine value for coarse aggregates

Experiment 8: (a)To determine compressive strength and water absorbtion of burnt clay bricks. (b) To assess the degree of efflorescence, dimensional tolerence and warpage in burnt clay bricks.

Experiment 9: To determine the physical and mechanical properties of reinforcing steel.

Experiment 10: To determine compressive strength and water absorbtion of fly ash bricks.

CE 1308 BUILDING PLANNING AND DRAWING (0-0-2)

UNIT I - To prepare working drawing of component of buildings i) Stepped wall footing and isolated RCC column footing, ii) Fully paneled and flush doors, iii) Half paneled and half-glazed window

UNIT II - To prepare working drawing of different staircases.

UNIT III - Functional design of building (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio

UNIT IV - Development of plan, elevation, section and schedule of openings from the given line diagram of Two storeyed residential buildings.

UNIT V Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram only for following building i) Primary health centre, ii) Primary school building

Text/ Reference Books:

1. Shah M.G. Kalec. M. & Patki SY Building Drawing, Tata Mcgraw Hill, New Delhi, 2000

CE1309 ENGINEERING GEOLOGY LAB (0-0-2)

Experiment 1: Identification of certain rock forming minerals
Experiment 2: Identification of certain igneous, sedimentary and metamorphic rocks
Experiment 3: Study of geological models
Experiment 4: Study of geological maps
Experiment 5: Study of thin sections

Text/ Reference Books:

1. K V G K Gokhale: Principles of Engineering Geology, B.S. Publications.
2. Prabin Singh: Engg. and General Geology, Katson Publishing House.
3. D.S. Arora: Geology for Engineers, Mohindra Capital Publishers, Chandigarh.
4. P.K. Mukerjee: A text Book of Geology, Calcutta Word Publishers.

CE1310 STRENGHT OF MATERIALS LAB (0-0-2)

Experiment 1: Tention test on mild steel
Experiment 2: Brinell hardness test
Experiment 3: Deflection test on beam
Experiment 4: Compression test
Experiment 5: Torsion test
Experiment 6: Double shear test
Experiment 7: Compound pendulum test
Experiment 8: Symmetrical bending test

SEMESTER-IV

CE 1401 Concrete Technology (3-0-0)

UNIT I : Materials : **Cement** – Ingredients, Chemical composition, basic properties of cement compounds, Hydration of cement- heat of hydration, physical properties of Portland cements, Indian standard tests and specification, various types and grades of cement, storage of cement

Aggregates:- Classification of aggregates. Characteristics of aggregates – Strength of aggregate, particle shape and texture, specific gravity, bulk density, porosity, water absorption and moisture content of aggregate, bulking of fine aggregate, deleterious substance in aggregate, soundness of aggregate , alkali- aggregate reaction , sieve analysis:- grading curves, fineness modulus, grading requirements, grading of fine and coarse aggregates, zoning, IS tests and specification for aggregates for concrete.

Water: - Quality of mixing water, effect of impurities in water on properties of concrete. permissible impurities as per I.S

Admixtures:- Functions and classification of admixtures, factors influencing the dosage of different admixtures- IS specification for admixtures for concrete. accelerators - retarders - plastizers - water reducing agents - use of silica fumes.

Process of manufacture of Concrete:- Mix proportion and grade of concrete - Various types of batching, mixing, transporting, placing, compacting, curing and finishing of concrete (in detail). Joints in concreting – construction and expansion

UNIT II : Properties of fresh concrete: Water / Cement ratio and its significance in fresh concrete-workability- different methods for assessing workability according to IS Specification, factors affecting workability, requirements of workability for various work, segregation, bleeding, setting, hardening, strength development.

UNIT III : Properties of Hardened concrete: Strength of concrete- strength of concrete in compression, tension and flexure - stress- strain characteristics and elastic properties - shrinkage and creep. durability of concrete - permeability - chemical attack - sulphate attack - resistance to abrasion and cavitaion - resistance to freezing and thawing - resistance to fire - marine atmosphere - quality control - frequency of sampling - test specimens - statistical analysis of test results - standard deviation - acceptance criteria.

UNIT IV : Special concrete: Lightweight concrete, High strength concrete, Polymer concrete, fiber reinforced concrete, Ferro-cement, Ready mixed concrete. vacuum concrete - shotcrete - steel fibre reinforced concrete- high performance concrete, reactive powder concrete, self-compacting concrete.

UNIT V : Non-destructive testing of concrete: Rebound hammer test, ultrasonic pulse velocity test, core cutter test.

UNIT VI : Mix Design: Quality Control - Factors causing variations in the quality of concrete - mix design - nominal mixes - design mixes - factors influencing mix design - A.C.I method - I.S method (IS 10262 - 2009) - design for high strength mixes.

Text/ Reference Books:

1. Neville, A. M. Concrete Technology. Pearson Education.
2. Neville, A. M. Properties of Concrete (4th edition). Pearson Education.
3. Santhakumar, A. R. (2013). Concrete Technology. Oxford University Press, India.
4. Orchard, D. F. Concrete Technology. Vol. I & II
5. Raju, K. N. Design of Concrete Mixes. CBS publishers.
6. Bungey, J. H. The Testing of Concrete in Structures. Urrey University of Press Hall.
7. Shetty, M. S. Concrete Technology. S I Chand & Company.
8. 8.Gambhin, M. L. Concrete Technology. Tata McGraw Hill.
9. 9.Thomas, J. (2015). Concrete Technology. Cengage Learning (India), 475p.

CE 1402 Survey-II   (3-0-0)

UNIT I : Curves : Types of curves - Basic definitions-Elements of a simple curve - Methods of setting out (Linear methods and Angular methods)-Compound Curves-Elements of a compound curve-Reverse Curve-Transition curves-advantages-super elevation- length of a transition curve - vertical curves-Types of vertical curves- length of the vertical curve.

UNIT   II : Triangulation : Principles of Triangulation-classification triangulation-reconnaissance-Selection of Triangulation Stations-Intervisibility of Triangulation stations-Determination of elevations of stations (No obstruction due to intervening ground and obstruction due to intervening ground) - Signals-Elevated towers-selection of site for base line-Base line measurement-corrections-Satellite station.

UNIT III : Adjustments of observations: Laws of weight-Corrections to filed measurements with a closing error-Theory of least squares-Normal equation method-Most probable values of directly observed quantities and indirectly observed quantities-Method of differences - Triangulation adjustments - Station adjustments for 3 different. Cases (when the horizon is closed with angles of equal weight

unequal weight-when several angles are measured at a station individually and also in combinations)- Figure adjustment of a plane triangle adjustment of two connected triangles-adjustment of a closed traverse.

UNIT   IV : Field Astronomy: Definitions - solution of astronomical triangle-Co-ordinate systems -Time - Solar-Sidereal and Standard-Equation of time-sun dial-Determination of time, azimuth, latitude and longitude.

UNIT V : Hydrographic Survey: Introduction - Shore Line Survey - River survey Soundings Methods of sounding - Method of locating soundings – plotting soundings-Three Point problem.

UNIT   VI : Photogrammetry: Phototheodolite -Principle of the method of Terrestrial photogrammetry - Field work - Stereo - Photogrammetry -aerial Surveying - Terminology - Scale and distortion of the vertical photograph - principle of Binocularvision and Stereoscopic fusion - Flight planning - plotting from Air Photographs - Heighting – Photo Interpretation Comparison between Air Photograph and Map -Application of Air photograph.

Text/ Reference Books:

1. Punmia, B.C, Jain, A. K. and Jain, A. K. (2010). Surveying. Vol. II. Laxmi Publications.
2. Arora, K. R. Surveying. Vol. II and III. Standard Book House.
3. Ghilani, C. D. and Wolf, P. R. Elementary Surveying. Prentice Hall.
4. Arora, K.R. Surveying. Vol. I and II. Standard Book House.

CE 1403 Structural Analysis-I   (3-1-0)

UNIT I : Introduction & Analysis of Plane Structures-Introduction and Classification of Structures, Review of AFD, SFD and BMD for Beams, Degrees of Freedoms, Static and Kinematic Indeterminacy of Structures, Analysis of Compound and Complex Trusses, Analysis of Plane Frames.

UNIT II : Displacements of Plane Structures-Introduction, Energy methods, Maxwell's Reciprocal & Betti's Theorem, Unit Load method, Deflection of trusses and plane frames.

UNIT III : Rolling Loads and Influence Line Diagrams-Introduction, Influence Line Diagrams for Beams & Trusses, Absolute Maximum Bending Moments, Muller- Breslau principle and its applications.

UNIT IV : Arches, Cables and Suspension Bridges- Introduction, Linear Arch, Eddy's Theorem, Three-Hinged & Two-Hinged Arches, Spandrel Braced Arch, Influence Lines for Arches, Analysis of Cables, Suspension bridges with three and two hinged stiffening girders.

UNIT V : Unsymmetrical Bending-Introduction, Location of Neutral axis, Computation of Stresses and deflections.

UNIT VI : Curved Beams-Bending of curved beams in plane of bending, stresses in bars with small and large initial curvatures, Beams Curved in plan.

Text/ Reference Books:

1. Structural Analysis, Hibbeler, Pearson Publications.
2. Structural Analysis, Aslam Kassimali, Cengage Learning Publications.
3. Structural Analysis in Theory and Practice, Alan Williams, Elsevier Publications.
4. Elementary Structural Analysis, C. H. Norris, J. B. Wilbur and S. Utku, Tata Mcgraw Hill
5. Structural Analysis, L.S. Negi and R. S. Jangid, Tata Mcgraw Hill Publications.

CE 1404 Fluid Mechanics-II (3-1-0)

UNIT I : Introduction to Open Channel Hydraulics-Introduction, difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation.

UNIT II : Uniform Flow in Open Channel-Introduction, Chezy's and Manning's equations for uniform flow in open channel, velocity distribution, most efficient channel section. Energy and momentum principles, Critical depth, concepts of specific energy and specific force, application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. IV Non-Uniform Flow in Open Channel, Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods, flow in channels of non-linear alignment.

UNIT III : Hydraulic Jumps, Surges, and Water waves-Classical hydraulic jump, evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, open channel surge, celerity of the gravity wave, deep and shallow water waves.

UNIT IV : Hydraulic Pumps-Rotodynamic pumps, classification on different basis, basic equations, velocity triangles, manometric head, efficiencies, pumps in series and parallel, multi-stage pumps, cavitation in pumps.

UNIT V : Hydraulic Turbines-Introduction to Hydroelectric power station, penstock and surge tank, water hammer (elastic theory), Rotodynamic machines, Pelton turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation.

UNIT VI : Performance Evaluation of Hydraulic Machines-Evaluation of performance of turbines and pumps, Main characteristics and operating characteristics, Muschel curves, Design point and operating point.

Text/ Reference Books:

1. Ranga Raju, K.G., Flow through open channels, T.M.H. 2nd edition.
2. Lal, J., Hydraulic Machines, Metropolitan Book Co. Pvt. Ltd., Delhi.
3. Ojha, C.S.P., Fluid Machinery and Applied Hydraulics, Oxford University Press, New Delhi.
4. Vasandani, V.P., Theory of Hydraulics Machines, Khanna Publishers, New Delhi.
5. Sawhney, G.S., Thermal and Hydraulics Machines, PHI Learning, New Delhi.
6. Majumdar, B., Fluid Mechanics with Laboratory Manual, PHI Learning, New Delhi.
7. Karassic, I.J., Pump Handbook, Tata McGraw Hill Ltd. New Delhi.
8. Som, S.K. and Biswas G, Introduction of Fluid Mechanics & Fluid Machines, TMH, New Delhi.

CE 1405 Geotechnical Engineering-I   (3-1-0)

UNIT I : Soil formation, Properties and Classification of soils-Soil mechanics and its importance, Particle size analysis, Phase relationship, Index properties, Soil structure and Clay mineralogy, Identification and Classification of soils, Soil Classification systems.

UNIT II : Permeability and Capillarity-Types of soil water, effective stress principle, Permeability and seepage of soils, Coefficient of permeability and its determination in laboratory and field, Quick sand,Seepage analysis, Flow nets and its construction, Seepage through earthen embankments.

UNIT III : Soil Compaction-Theory of compaction, Standard and Modified Proctor test, Effect of compaction on properties of soils, Field compaction of soils, Compaction control in fields.

UNIT IV : Consolidation of Soils-Compressibility of soils, Types of consolidation, Terzaghi's theory of consolidation, Consolidation test, Determination of coefficient of consolidation, Pre-consolidation pressure and its determination, Time rate of consolidation, Computation of settlement.

UNIT V : Shear Strength of Soils-Mechanism of shear resistance, Mohr-Coulomb theory, Shear strength and effective stress principle, Shear tests under different drainage conditions, Pore pressure parameters, Shear characteristics of cohesionless and cohesive soils, Liquefaction phenomenon, Modified failure envelop, Stress path.

UNIT VI : Stresses in Soils:Causes of stress in soil, Geostatic stress, Boussinesq's equation, Stress distribution diagrams, Vertical stress in soils under different types of loading, Newmark's influence chart, Westergard's equation.

Text/ Reference Books:

1. Lambe & Whitman: Soil Mechanics, Wiley-India.
2. Gopal Ranjan and A.S.R. Rao: Basic and Applied Soil Mechanics, New Age International
3. B. M. Das: Principles of Geotechnical Engineering, CL-Engineering.
4. D.F. Mc Garthy: Essentials of soil mechanics and foundation. New Age International
5. Alam Singh: Modern Geotechnical Engineering., CBS publisher
6. K.R. Arora: Soil Mechanics and Foundation Engineering, Standard Publishers Distributors
7. Purushotama Raj: Geotechnical Engineering, New Age International Limited

CE 1406 Design of Concrete Structures-I (3-1-0)

UNIT I: Working Stress Design-Introduction to Reinforced Cement Concrete, Working Stress Design Method, Assumption, Distribution of Stresses on the cross section in bending, transformed area, Analysis and Design of a rectangular singly and doubly reinforced section

UNIT II: Limit State Design-Limit State Design Method, Assumptions, Distribution of stresses on the cross section in bending, Analysis and Design of a rectangular singly and doubly reinforced section, T and L sections.

UNIT III: Behaviour of Section in Shear & bond-Behaviour of RC beam in shear, shear strength of beam with and without shear reinforcement, Minimum and Maximum shear reinforcement, Design of beam in shear using Limit state method. Nature of bond between steel and concrete. Development of bond stress in reinforcement, Concept of development length and anchorage, Design of RC section in bond and calculation of development length using Limit state methods.

UNIT IV: Design of Slab & Staircase-Design of one-way and two-way solid slabs, and design of staircase.

UNIT V: Design of Compression Members-Classification of Compression members, Effective length, Slenderness ratio and slenderness limit, Axially loaded short column's design Limit State methods, Increase in permissible load in helically reinforced columns. Eccentrically loaded columns, Minimum eccentricity, Pu & Mu interaction diagrams

UNIT VI: Design of Columns using IS-456 Design Aids with Uniaxial and biaxial bending

Text/ Reference Books:

1. Fundamentals of Reinforced Concrete Structures, M L Gambhir, PHI
2. Reinforced Concrete Design, A K Jain, Nem Chand
3. Reinforced Concrete Design, P Dayratnam, Oxford IBH
4. Reinforced Concrete, Pillai & Menon, TMH

5. Limit State Design of Reinforced Concrete, P. C. Varghese, PHI.

CE 1407 Concrete Lab (0-0-2)

LIST OF EXPERIMENTS :

1. Determination of properties of coarse, fine and cement for mix design of concrete
2. Mix Design of concrete.
3. 3.Determination of of fresh concretes: slump and compaction factor tests.
4. Compression test on concrete cubes
5. Split-tensile test on concrete cylinders.
6. Flexure test on concrete.
7. Determination of Modulus of elasticity of concrete.
8. Determination of compressive strength by Rebound hammer test
9. Determiation of quality of concrete by Ultrasonic Pulse Velocity Test and Scanning of RC structure
10. Determination of compressive of concrete by core test

CE 1408 Survey Field Work (0-0-2)

Plane Table survey:

1. Method of Radiation.
2. Method of Intersection.
3. Solving three point problem - Bessel's method.
4. Solving three point problem - trial and error method & tracing paper method.
5. Solving two point problem.

Leveling:

6. Study of leveling instruments.
7. Fly leveling.
8. Longitudinal sectioning.
9. Cross sectioning.
10. Contour surveying.
11. Permanent adjustments.

Theodolite

12. Study of Theodolite.
13. Permanent adjustments of Theodolite.
14. Determination of Tacheometric Constants.
15. Heights and distances by stadia tacheometry.
16. Heights and distances by tangential tacheometry.
17. Heights and distances by solution of triangles.
18. Setting out simple curve-angular methods.
19. Demonstration of Total Station.

CE 1409 Fluid Mechanics Lab (0-0-2)

Experiment 1: To study the characteristics of hydraulic jump in an open channel.
Experiment 2: To study the velocity distribution on an open channel and to determine the energy and momentum correction factors.
Experiment 3: To study performance of two Centrifugal pumps connected in series and parallel.
Experiment 4: To study performance of a Reciprocating pump.
Experiment 5: To study the impact of jets on a flat plate.
Experiment 6: To study performance of a Pelton wheel.
Experiment 7: To study performance of a Francis turbine.
Experiment 8: To study performance of a Kaplan Turbine.

Text/ Reference Books:
1. Singh, S. Experiments in Fluid Mechanics, PHI Learning, New Delhi.
2. Prakash, M.N.S., Experiments in Hydraulics and Hydraulic Machines: Theory and Procedures, PHI Learning, New Delhi.

SEMESTER-V

CE 1501 Structural Analysis – II   (3-1-0)

UNIT I : Introduction-Introduction, Force and Displacement Methods of Analysis of Indeterminate Structures, Method of Consistent Deformation for beams and plane frames.

UNIT II : Strain Energy Methods-Introduction, Method of Minimum Strain Energy for indeterminate beams, Trusses and plane frames.

UNIT III : Moment Distribution and Slope Deflection Methods-Introduction, Moment distribution and Slope Deflection methods for continuous beams and plane frames.

UNIT IV : Matrix Method of Analysis-Introduction, Flexibility Method- Application to Beams, Trusses, Frames and Grid Structures; Stiffness Method- Application to Beams, Trusses, Frames and Grid Structures (including plane and space structures.

UNIT V : Computer Oriented Direct Stiffness Method-Introduction, Application to Beams, Frames and Trusses.

UNIT VI : Plastic Analysis of Structures-Introduction, Analysis of Plastic Structures.

Text/ Reference Books:

1. Structural Analysis, Hibbeler, Pearson Publications.
2. Structural Analysis, Aslam Kassimali, Cengage Learning Publications.
3. Structural Analysis in Theory and Practice, Alan Williams, Elsevier Publications.
4. Elementary Structural Analysis, C. H. Norris, J. B. Wilbur and S. Utku., Tata Mcgraw Hill Publications.
5. Structural Analysis, L.S. Negi and R. S. Jangid, Tata Mcgraw Hill Publications.
6. Intermediate Structural Analysis, C. K. Wang, Tata Mcgraw Hill Publications.
7. Matrix Analysis of Framed Structures, W. Weaver (Jr.) and J. M. Gere, CBS Publications.

CE 1502 Geotechnical Engineering - II   (3-1-0)

UNIT I : **Earth Pressure and Retaining Walls**:Types of lateral earth pressure, Rankine's and Coulomb's earth pressure theory, Graphical methods of determination of lateral earth pressures, Sheet pile walls: Types and uses of sheet piles – Design of cantilever and anchored sheet pile walls (Free earth support only).

UNIT II : **Stability of Slopes-**Types of slope failure, Stability of infinite and finite slopes, Taylor's stability number, Stability analysis – Culmann's method, Swedish Circle method, Friction circle method, Bishop's method, Stability charts.

UNIT III :**Site investigation and soil Exploration:** Objectives**-**Planning- reconnaissance-methods of subsurface exploration-Test pits-Auger borings-rotary drilling-depth of boring-boring log-soil profile-location of water table,Sampling-disturbed and undisturbed samples,soil investigation report.

UNIT IV : **Foundation:** Function of foundation, Definition of shallow and deep foundation, different types of foundation-selection of type of foundation,proportioning of shallow foundation,Raft foundation and floating raft,Fondation Settlement- causes,effects and remedial measures of total and differential settlements,Permissible total and differential settlements as per IS recommendation.

UNIT V :**Shallow Foundations:**Ultimate bearing capacity and allowable soil pressure,Terzaghi's theory of bearing capacity for continuous, circular and square footings, bearing capacity factors and charts,Skempton's analysis,IS code method,effect of water table on bearing capacity, Raft foundation-bearing cap[acity equation-design considerations,Bearing capacity based on tolerable settlement,Field tests-S.P.T, Cone penetration tests,Plate load test.

UNIT VI : **Deep Foundations**:Pile Foundation-Types of pile foundation,selection of type of piles , Pile capacity by static and dynamic formulae, Determination of Pile acapacity by penetration tests and pile load tests (IS methods),Negative skin friction, Group action of piles, Settlement of pile groups,Under reamed piles – analysis and design,Cassion and cofferdams-Types of wells, Component of wells, Depth and bearing capacity of well foundation, Forces acting on well foundation, Construction and sinking of well foundation, Measures to prevent and rectify tilts and shifts, types and uses of cofferdams.

Text/ Reference Books:

1. J.E. Bowels: Foundation Analysis and Design, McGraw-Hill.
2. W. C. Teng : Foundation Design, Prentice-Hall.
3. B. M. Das: Principles of Foundation Engineering, PWS Publishing.
4. K.R. Arora : Soil Mechanics and Foundation Engineering, Standard Publishers Distributors.
5. P. C. Varghese: Foundation Engineering, PHI Learning Private Limited.
6. V. N. S. Murthy: Advance Foundation Engineering, CBS Publisher.
7. Nainan P. Kurian: Design of Foundation Systems, Narosa Publishing House.

CE 1503 Water Resources Engineering (3-1-0)

UNIT I: Hydrology- Introduction, hydrologic cycle, water budget equation. Statistics and probabilities in hydrology- statistical parameters, probability distribution, frequency analysis, confidence limits, regression and correlation, analysis of time series.

UNIT II: Precipitation- forms of precipitation, measurement of rainfall, rain gauge network, estimation of missing data, depth-area-duration relationships, intensity-duration-frequency relationships, probable maximum precipitation.

UNIT III: Abstractions from precipitation: Evaporation- evaporation and its estimation, methods to reduce reservoir evaporation. Evapotranspiration (consumptive use) and its estimation. Infiltration-infiltration capacity, factors affecting infiltration, measurement of infiltration, infiltration indices. Rainfall-runoff analysis- runoff characteristics of streams, flow duration curves, flow mass curve, sequent peak algorithm.

UNIT IV: Groundwater- aquifer properties, confined and unconfined aquifers, steady flow and unsteady flow equation, well hydraulics, specific capacity.

UNIT V: Hydrographs- components of hydrograph, base flow separation, unit hydrograph, derivation of unit hydrograph, UH of different durations, S-hydrograph, synthetic unit hydrograph.

UNIT VI: Design flood, flood peak estimation for ungauged catchments, rational method and empirical equations. flood estimation for gauged catchments-flood frequency analysis. Flood routing- routing methods, hydrologic channel routing- Muskingum method, hydrologic storage routing- modified Puls method. Water resources development- Planning, design and economics of water resources development.

Text/ Reference Books:

1. Subramanya, K., Engineering Hydrology, Tata Mc Graw-Hill Pub. Co. ltd, New Delhi

2. Patra, K. C., Hydrology and Water Resources engineering, Narosa Publishing House, New Delhi

3. Jayarami Reddy, P. A text book of Hydrology, Laxmi Publications, New Delhi.

4. Garg, S. K., Water Resources and Hydrology, Khanna Publishers, New Delhi.

5. Linsley, R. K., and J. B. Franzini, Water Resources Engineering, Mc Graw-Hill, Inc.

6. Larry W. Mays, Water Resources Engineering, John Wiley & Sons, Inc.

CE 1504   Design of Steel Structures   3-1-0

UNIT I: Materials and specifications: rolled steel sections- types of structural steels – specifications-Limit state and working stress design concepts, Residual Stresses **Types of connections** – *Bolted joints*- Types of bolted joints-load transfer mechanism-failure of bolted joints-efficiency of the joint, advantages and disadvantages of bolted joints, Prying Action - *welded joints*-advantages and disadvantages of welded joints – types of welds and their symbols -Design of welded and bolted connections.

UNIT II: Tension member: Types of Tension members, Net sectional area – permissible stresses, Types of Failure – design of axially loaded tension member, Lug Angle, Gusset plate.

UNIT III: Compression member: effective length – slenderness ratio, types of buckling, design of compression members - axially loaded compression member, built-up columns— lacing and battening for built-up compression member, Compression member subjected to combined axial load and bending moments – column base – slab base – gussetted base.

UNIT IV: Beams: classification of sections, design of laterally supported and unsupported beams – design of built-up beams, lintels and purlins.

UNIT V: Plate girders- elements of plate girder, design of section, curtailment of flange plate, bearing and intermediate stiffeners, connections, flange and web splices, Gantry girders (introduction).

UNIT VI: Plastic design- basic assumptions - shape factor, load factor- Redistribution of moments - upper bound lower bound and uniqueness theorems- analysis of simple and continuous beams, two span continuous beams and simple frames by plastic theory - static and kinematic methods, Plastic design- Design of section for Continuous beams and simple frames.

Text/ Reference Books:

1. Duggal, S. K. Design of Steel Structures. Mc Graw Hill Publication.
2. Subramanian, N. Design of steel structures. Oxford University Press.
3. Subramanian, N. Steel structures: Design and Practice. Oxford University Press.
4. L. S. Negi, Design of Steel Structures. Mc Graw Hill Publication.
5. Leonard Spiegel, George F. Limbrunner. Applied Structural Steel Design. Prentice Hall
6. N. S. Trahair, M. A. Bradford, D. A. Nethercot, L. Gardner. The Behaviour and Design of Steel Structures. Taylor and Francis.
7. Denis Lam, Thein-Cheong Ang, Sing-Ping Chiew. Structural Steel Work. Elsevier.
8. Use of IS:800 – 2007, IS:801 – 1975, IS:811 – 1987, SP-6 and structural steel table are permitted in the examination hall.

CE 1505   Environmental Engineering-I   (3-1-0)

UNIT I : Scope of Environmental Engineering, Global environmental problems, Water supply Engineering: Rural and Urban water supply systems - Water demand – per-capita demand, factors affecting per capita demand, variations in the rate of consumption, fire demand, design period, forecasting population. Quality of water – impurities in water and their importance - water borne diseases - analysis of water - physical, chemical and bacteriological tests. WHO and Indian standards for drinking water.

UNIT II : Sources of water: Surface water sources- groundwater sources. Collection of water: intakes - location, types, pipe materials- design of gravity and pumping main. Pumps: classification - selection of pumps - location of pumping stations. Distribution systems-different layout of pipe networks - appurtenances in the distribution system - meters, valves, fire hydrants etc. pipe laying, testing & disinfections of mains- detection and prevention of leaks in distribution system-maintenance of distribution system. Storage of water - effect of storage on quality of water.

UNIT III : Sanitary plumbing: Sanitary fixtures-Systems of piping-House drainage-Connection of house drains and street sewers. Systems of sewerage-Quantity of storm sewage-Quantity of sanitary sewage -Sewers, types, materials, shape, construction, appurtenances, hydraulic design of sewers, sewage pumping, ejectors, sewer junctions-maintenance, inspection and ventilation of sewers.

UNIT IV : Natural methods of wastewater disposal: land disposal-Sewage farming-disposal by dilution-self-purification of streams-oxygen sag curve-dilution into sea, comparison of disposal methods. Air pollution: type of pollutants, sources, health effects, meteorological aspects, ,

monitoring and air pollution control. Solid waste management: type, sources, characteristics, collection, vehicles for transportation and processing – Disposal: composting, sanitary land fill, incineration. Noise pollution: Sources, effects, control, noise survey.

Text/ Reference Books:

1. Garg, S. K. (2001). Environmental Engineering. Vol I & II. Khanna publications, New Delhi.
2. Birdic, G. S. and Birdic, J. S. (1998). Water supply and Sanitary Engineering. DhanputRai & Sons, New Delhi.
3. Rowe, P. and Tchobanoglous. Environmental Engineering. McGraw Hill International Editions.
4. Veslind and Morgan. Introduction to Environmental Engineering. Thomson Learning.
5. Rao, M. N. and Rao, H. V. N. Air Pollution. Tata McGraw Hill Pvt. Ltd, New Delhi.
6. Hammer, M. J. and Hammer, M. J. (Jr). (1998). Water and Wastewater Technology, Prentice Hall of India, Pvt Ltd, New Delhi.
7. CPHEEO, Manual on Water Supply and Treatment. Third edition. Ministry of Urban Development, Gov. of India

CE 1506 Geotechnical Engineering-I Lab (0-0-2)

Experiment 1: Visual identification and specific gravity

Experiment 2: Sieve Analysis

Experiment 3: Hydrometer Analysis

Experiment 4: Atterberg's Limits & Free swell Index

Experiment 5: Relative Density Test

Experiment 6: Proctor Compaction Test

Experiment 7: Field Density by Sand Replacement Method.

Experiment 8: Permeability Test

Experiment 9: Direct Shear Test

Experiment 10: Vane shear test

CE 1507   Detailing of structures   (0-0-2)

LIST OF EXPERIMENTS

1. Detailing of RCC Beams. Beam Profiles.
2. Detailing of RCC Slabs.

3. Detailing of RCC Columns. Column Schedule.
4. Detailing of RCC Footings.
5. Detailing of steel Connections.
6. Detailing of Steel Column & Column bases.
7. Detailing of Trusses Members & Gusset plates.
8. Detailing of Portal Frames.
9. Detailing of Industrial shed.

CE 1508   Environmental Engineering Lab   (0-0-2)

LIST OF EXPERIMENTS

1. Determination of solids (total, dissolved, organic, inorganic and settleable) in water.
2. Determination of turbidity and optimum coagulant dose.
3. Determination of acidity, alkalinity and pH of water.
4. Determination of hardness and chlorides in water.
5. Determination of iron in water.
6. Determination of sulphates and sulphides in water.
7. Determination of D.O and BOD of waste water.
8. Determination of COD of waste water
9. Determination of available chlorine in bleaching powder and the chlorine dose required to treat the given water sample.
10. Determination of manganese in water.
11. Determination of coliforms in water.

Text/ Reference Books:

1. Standard methods for the examination of water and wastewater. (2012). 21st Edition. Washington: APHA.
2. Sawyer, C. N., McCarty, P. L. and Perkin, G. F. (2002). *Chemistry for Environmental Engineering and Science*. 5th edition. McGraw-Hill Inc.
3. Kotaiah, B. and Swamy, N. K. (2007). *Environmental Engineering Laboratory Manual*. First edition. Charotar Publishing House Pvt. Ltd.

SEMESTER-VI

CE 1601   Design of Concrete Structure-II   (3-1-0)

UNIT 1: Design of Footings-Structural behaviour of footings, design of footing for a wall and a single column, combined footings, Design of strap footing, Design of mat footing.

UNIT II: Design of Beams for Flexure, Shear & Bond-Failure of beam under torsion, interaction between shear and torsion and between moment and torsion, Concept of equivalent shear and moments. Analysis and design of beam curved in plan.

UNIT III: Design of Flat & Circular Slabs-Design of flat slabs with and without drops. Circular slabs with various edge and loading conditions, and their usages. Design of coffer slab.

UNIT IV: Design of Circular Water Tanks-Water tanks: Design criteria, material specifications and Permissible stresses for water retaining structures, Design of circular water tanks with fixed & flexible base situated on the ground/underground.

UNIT V: Design of Rectangular Water Tanks-Design of square /rectangular tanks situated on the ground/underground using approximate method and IS- code method.

UNIT VI: Design of Retaining Walls-Structural behaviour of retaining wall, stability of retaining wall against over-turning sliding and pressure developed under the base, Design of T-shaped retaining wall, Concept of counterfort retaining wall.

Text/ Reference Books:

1. Reinforced Concrete Design, Limit State Method ,Jain A.K. , NemChand
2. Reinforced Concrete Structures , M L Gambhir , PHI
3. Reinforced Concrete Design , Pillai & Menon , TMH
4. Design of Reinforced Concrete Structures , Dayaratnam , P. , Oxford IBH
5. Prestressed Concrete , Krishna Raju , N , CBS
6. IS 456-2000: Code of practice for plain & reinforced concrete.
7. SP-16: Design Aids of Reinforced Concrete to IS: 456-1978.
8. IS 3370-1968 & IS 3370-2009: Code of practice for water retaining structures.
9. Reinforced Concrete Designer,s Handbook, Charles E. Reynolds

CE 1602   Transportation Engineering-I   (3-1-0)

UNIT I : Highway Development in India; Institutions for Highway Development at National level; Methods of Highway Planning. Highway Planning and Alignment-Introduction to transport systems; various modes of transportation. Requirements of Ideal Alignment, Factors controlling highway alignment; engineering surveys for highway planning.

UNIT II : Geometric Design of Highways- Classification and cross section of urban and rural roads (IRC), Highway cross sectional elements. Sight distances - Cross sectional elements, camber, shoulder Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Head light Sight Distance, Sight Distance at Intersections and Intermediate Sight. Design of Horizontal and Vertical Alignments.

UNIT III : Traffic Engineering-Traffic characteristics Volume studies; Speed study; Traffic flow characteristics; capacity, density; Traffic control devices: Signs, signals, island; intersections: at grade and grade separated intersections, rotary intersection, and design of signals at intersections.

UNIT IV : Pavement Analysis and Design-Rigid and Flexible Pavements: Components and their functions, Design principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements: ESWL, Climate, Sub-grade Soil and Traffic, Design Practice for Flexible Pavements [CBR method, IRC Method and Recommendations- Problems], Design Practice for Rigid Pavements – [IRC Recommendations-Problems], Joints.

UNIT V : Highway Construction-Material Specification and Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications], Highway Drainage [IRC Recommendations]

UNIT VI : Highway Failures and Maintenance-Types of defects in Flexible and Rigid pavements, their Symptoms, Causes and Treatments, Special Repairs. Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening -Overlay design by Benkelman Beam Method.

Text/ Reference Books:

1. Highway Engineering by S.K. Khanna and C.E.J. Justo, Nem Chand Publication.
2. Transportation Engineering by Animesh Das and P. Chakravorhy, Tata McGraw Hill.
3. Principle and Practices of Highway Engineering by L.R. Kadiyali and N.B. Lal, Khanna Publishers.

CE 1603   Environmental Engineering-II   (3-0-0)

UNIT I : Introduction to Water Treatment-Water Treatment units, processes, flow sheets. Sedimentation: - Theory and mechanisms, Removal efficiency of discrete and flocculent particles, Design of primary and secondary settling tank.

UNIT II : Coagulation and Flocculation-Coagulation, Mechanisms of coagulation, optimum dose of coagulants, design of rapid mixer. Flocculation: Theory and mechanisms, design of hydraulic and mechanical flocculator.

UNIT III : Filtration, Disinfection and Softening: Filtration: Theory and mechanisms, hydraulics of filtration and back-washing, Design of Slow sand filter, Rapid sand filter, dual and multi-media filters. Disinfection, methods of disinfection, various forms of chlorine application and equipments, Water Softening: Methods of water softening, estimation of dose of chemicals.

UNIT IV : Introduction to Wastewater Treatment-Wastewater Treatment: Unit operations and unit processes, primary, secondary and tertiary treatments, BOD kinetics. microbial growth kinetics and various relationships, Design of Primary treatment units.

UNIT V : Secondary Treatments- Aerobic-Secondary treatment: Biological treatment- its principle, Design of Activated sludge process- and modifications, trickling filter-theory and design, design of oxidation ponds and oxidation ditches and rotating biological contactor.

UNIT VI : Anaerobic Treatment and Disposal of Effluent-Principles of Anaerobic Treatment, Introduction to sludge treatment, anaerobic digestion of sludge, design of anaerobic digester and septic tank. Disposal of wastewater on land and in water bodies, stream sanitation.

Text/ Reference Books:

1. Masters: Introduction to Environmental Engineering and Science, Prentice Hall Publication.
2. McGhee: Water supply and sewerage, Tata McgrawHill, publication.
3. Peavy, Rowe and Techbanoglous: Environmental Engineering, Tata McgrawHill, publication.
4. Garg S. K.: Environmental Enggineering (I&II), Khanna publication, New Delhi.
5. MetCalf & Eddy: Wastewater Engineering: Treatmment and Reuse, Tata McgrawHill, publication.
6. Mannual on Water Supply and Treatment, CPHEEO, Govt. of India.
7. Mannual on Sewerage and Sewage Disposal, CPHEEO, Govt. of India.

CE 1604   Estimating & Costing & Valuation   (3-0-0)

UNIT I : Estimation Fundamentals-Importance of estimation, different types of estimates, general and detailed specifications. Methods of Estimation: Items of work for estimates, units and measurement of items.

UNIT II : Detailed Estimation of Buildings and Analysis of Rates- Detailed estimates of a single roomed and a two roomed single storey residential building. Estimates of Steel Framed Industrial Building:, Analysis of rates, material and other cost considerations. Resource planning through analysis of rates, market rates, PW.D. Schedule rates, non scheduled items and cost indices for building material and labour.

UNIT III : Establishments, Organization Structures and Standard Work Procedures- Organization set up for various works departments. Duties and responsibilities of officers. Administrative, Technical and Financial approvals, System of P.W. accounts, Cash and cash book, Temporary advance, Stores, Issue of stores, Material at site account, Measurement and standard measurement book. Release of payments. Defect Liability considerations.

UNIT IV : Valuation of Assets-Standard Terminology, Factors affecting the values of property. Methods of valuation, years purchase, capitalized value and depreciation. Standard rent, free hold and lease hold propriety, Mortgage and easement.

UNIT V : Estimation for Mechanized Construction and Infrastructure Projects-Estimation for mechanized construction including slip forming pumped concreting. Equipment costs and productivity analysis. Estimation of highways /irrigation/ airways projects including cross drainage structures.

UNIT VI : Computer Aided Estimation and Costing-Application of computer software for estimation and costing.

Text/ Reference Books:

1. Chakraborty M., "Estimating costing and valuation in Civil Engg., Principle and applications (Authors Publication, Kolkata)
2. Frederick E. Gould. "Managing the Construction Process Estimating, Scheduling and Project Control", Pearson Education
3. B.N. Dutta "Estimating & Costing in Civil Engineering," UBS Publishers & Distributors Pvt. Ltd. New Delhi.
4. CPWD Works Manual 2012.

CE 1605   Geotechnical Engineering – II Lab   (0-0-2)

LIST OF EXPERIMENTS

Experiment 1: Unconfined Compression Test

Experiment 2: Triaxial Compresssion test

Experiment 3: CBR Test

Experiment 4: Consolidation test

Experiment 5: Methods of soil exporation

Experiment 6: Standard penetration test

Experiment 7: Plate load test.

Experiment 8: Planning of site investigations for a real life problem

Experiment 9: Swelling pressure test

Experiment 10: Pile load test

CE 1606   CAD LAB   (1-0-2)

1. Structural detailing using AutoCadd.
2. Structural Design using Staad.Pro.V8i. & SAP.
3. Analysis using ANSYS (WORKBENCH & APDL).
4. Programming using MATLAB. Designing structural design templates on Microsoft Excel.
5. Learning Geo-5 and PlAXIS.

CE 1607   Transportation Engineering Lab   (0-0-2)

Experiment 1: Shape Test – Flakiness Index, Elongation Index & Angularity Number

Experiment 2: Crushing Value

Experiment 3: Los-Angeles Abrasion Value

Experiment 4: Impact value & Deval Attrition test

Experiment 5: Penetration Test

Experiment 6: Viscosity Test

Experiment 7:. Ductility Test

Experiment 8: Softening Point Test

Experiment 9: Flash & Fire Point Test

Experiment 10: Marshall Stability Test

SEMESTER-VII

CE 1701   Structural Dynamics and Earthquake Resistant Design (3-1-0)

UNIT-I: Formulation and solution of SDOF dynamical systems; undammed and damped Systems, free and forced vibrations
UNIT-II: Formulation and solution of MDOF dynamical systems.
UNIT-III: Duhamel's integration; Dynamic load factor; Model Analysis.
UNIT-IV: Introduction to random vibration Behaviour of structures during cyclone and earthquake.
UNIT: V : Analysis of framed structures due to earthquake with special reference to IS codes.
UNIT-VI: Design and detailing criteria of earthquake resistant structures.

Text/ Reference Books:

1. Dynamics of Structures: theory and applications to Earthquake Engineering by-A. K. Chopra
2. Structural Dynamics-theory and computation by-Mario Paz.
3. Design of Earthquake Resistant Structures by M. Shrikhande & Pankaj Agrawal
4. Earthquake Resistant Design of Structures by S. K. Duggal, Oxford Press

CE 1702   Irrigation Engineering   (3-1-0)

UNIT- I: Soil-water-crop relations; Irrigation requirement of crops; Irrigation methods.
UNIT- II: Concepts of storage and diversion schemes. Aqueducts and super passage.
UNIT- III: Design of barrages based on surface and sub-surface flow criterion; Design of canals head regulators and cross drainage works; Design of canals;
UNIT- IV: Types of dams – Gravity, earth, rock fill Arch and Buttress;
UNIT- V: Types of spillway and energy dissipaters, gates and sluices; Flood routing through spillways;
UNIT- VI: Hydropower engineering systems – principal components.

Text/ Reference Books:

1. Water Resources Engineering by R.A .Wurbes & W.P.James

CE 1703   Transportation Engineering-II   (3-0-0)

UNIT I : Introduction-Introduction to Indian Railways, Modes of Transportation, Classification of Railway Lines in India, Undertakings under Ministry of Railways.

UNIT II : Components of Track and Track Alignment-Permanent way, Rail gauges, Coning of wheels, Rails, Creep of rail, Rail Fastenings, Sleepers, sleeper density, Ballast, Traction and Tractive Resistances. Alignment of Railway Lines, Engineering Surveys, Plate laying methods. 8

UNIT III : Geometric Design of Track-Gradients, Grade compensation on curves, Super elevation, Cant deficiency and Cant excess, Negative Super elevation. Curves, Extra clearance on curves, permissible speed on tracks, Widening of gauges on curves.

UNIT IV : Points and Crossings & Signalling-Switches, Components and types of crossing, Turnouts, Desgin of turnouts. Signalling: Classification, Signalling systems, systems for controlling train movements, Interlocking.

UNIT V : Stations and Yards-Classification of railway stations and yards; platforms, sidings.

UNIT VI : Airport Engineering-Air Transport in India, Components of Air Transportation, Air craft characteristics affecting airport design, Airport Planning, Runway Design: runway orientation; basic runway length; corrections to runway length. Airport Configuration: Runway configurations and operations, Taxiway configurations,. Runway pavement design, design of overlay, Airport Layout, Runway lighting and Marking.

Text/ Reference Books:

1. Railway Engineering by Satish Chandra and M. M. Agarwal, Oxford University Press.
2. A Text Book of Railway Engineering by S. C. Saxena and S. P. Arora, Dhanpat Rai Publications.
3. Airport Planning and Design by S. K Khanna, M.G. Arora and S.S Jain,Nem Chand & Bros. Roorkee.

CE 17XX   Open Elective-I   (3-1-0)

CE 17XX   Professional Elective - II   (3-0-0)

CE 1704   Projects & Industrial Training   (0-0-6)

CE 1705 Computational Methods in Civil Engineering (1-0-2)

To develop C/C++ programs for the following:

UNIT I: Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT II: Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III: Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV: Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

UNIT V: Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TEXT/ REFERENCE BOOKS:

1. Grewal. B.S., and Grewal. J.S.,"Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007
4. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
5. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007.
6. Balaguruswami E., "Object Oriented Programming with C++", McGraw Hill Education India Pvt Ltd.

7. Balaguruswami E., "Programming in ANSI C", McGraw Hill Education India Pvt Ltd.

SEMESTER-VIII

CE 1801   Prestress Concrete Design   (3-0-0)

UNIT I: Concrete of Mechanics; Materials of sections; Stress analysis-three methods.

UNIT II: Pre-stressing and post stressing, Beam design-no tension and ultimate

UNIT III: Loss assessment, poles and slab panels,

UNIT IV: Composite beams, Design for shear

UNIT V: Large span structures, Structural forms and design principles

UNIT VI: Special materials, open web and built-up structures

Text/ Reference Books:

1. Pre-stressed concrete by- N. Krishna Raju
2. Pre-stressed concrete by-T. Y. Lin

CE 1802 Civil Construction, Planning and Management (3-0-0)

UNIT I: Construction Engineering Systems: An Over View-Brief introduction to construction projects - magnitude and critical considerations. Principles and process of management, Managerial role of engineers. Project cycle. Resources involved in construction projects. Classification of projects, Modeling of construction projects for managerial controls using bar charts, milestone charts, and network diagrams. Resource quantification.

UNIT II: Network Techniques and LOB- Deterministic and probabilistic networks, CPM, PERT, PDM and GERT. Critical path evaluation, cost planning and resource allocation through network techniques. Project monitoring and controls, Line of balance technique. .

UNIT III: Engineering Economics & Construction Contracts and Delivery Methods-Time value of money, Present economy studies, Equivalence concept, financing of projects including PPP, economic comparison, Depreciation and break even cost analysis. Contract management legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts. Managing contracts and disputes.

UNIT IV : Construction Procedures-Tenders and tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract, extra items, settlements of disputes, arbitration and commissioning of project.

UNIT V : Construction Equipment Management-Different types of construction equipments viz. Excavating, Hauling, Lifting and Concreting equipments, Scrapers. Cost of owning and operating, economic life of equipment, factors influencing performance of equipment, Rolling resistance, Coefficient of traction, Rimpull, drawbar pull. Safety during mechanized construction. Time motion studies.

 UNIT VI: Application of Optimization Techniques in Construction Planning & Management and Software Applications- Application of Linear Programming Techniques to construction project management, Transportation and Assignment Models in construction management. Decision making under risk – Decision tree concept, MS Project and Primevera Project Planner.

Text/ Reference Books:

1. Charles, Patrick. "Construction Project Planning and Scheduling", Pearson Education.
2. Peurifoy R.L., and Schexnayder, Clifford J., Construction Planning", Equipment and Methods, T.M.H., International Book Company.
3. Panneerselvam, R., Engineering Economics, Prentice- Hall of India Private Limited New Delhi.
4. Wiest, Jerome D., and Levy Ferdinanad K., A management Guide to PERT/ CPM: with GERT/PDM/DCPM and other Networks. - Hall of India Private Limited New Delhi.
5. Seetharaman, S., Construction Engineering and Management, Umesh Publications New Delhi.
6. Taha, Hamdy A., Operations Research – An Introduction , Prentice- Hall of India Private Limited New Delhi (2006).

Professional Elective – I

S.No.	Subject Code	Subject Name
1	CE 1608	Ground Improvement Techniques
2	CE 1609	Advanced Foundation Design
3	CE 1610	Earth Pressures and Retaining Structures
4	CE 1611	Soil Dynamics and Machine Foundation
5	CE 1612	Traffic Safety and Assessment
6	CE 1613	Transportation System and Planning

Professional Elective – II

S.No.	Subject Code	Subject Name
1	CE 1706	Water Supply Systems
2	CE 1707	Remote Sensing and GIS Applications for Land and Water Resources
3	CE 1708	Hydraulic Structures & Hydro power Engineering
4	CE 1709	Environmental Impact Assessment
5	CE 1710	Computational Intelligence for Hydro Systems
6	CE 1711	Embakment Dam Engineering

Professional Elective – III

S.No.	Subject Code	Subject Name
1	CE 1804	Bridge Engineering
2	CE 1805	Theory of Elasticity
3	CE 1806	Finite Element Method
4	CE 1807	Construction Safety and Fire Engineering
5	CE 1808	Advanced Concrete Design
6	CE 1809	Offshore Structures

Professional Elective – IV

S.No.	Subject Code	Subject Name
1	CE 1810	Port and Harbour Engineering
2	CE 1811	Disaster Management
3	CE 1812	High Rise Structures
4	CE 1813	Solid Waste Management
5	CE 1814	Environmental Pollution and Control
6	CE 1815	Traffic Engineering
7	CE 1816	Rock Engineering

Professional Elective – I   (3-0-0)

CE 1608 Ground Improvement Techniques

Introduction, Need for ground improvement, Historical review of methods adopted in practice, Current status and the scope, Economic considerations, Surface compaction, Dynamic Compaction, Consolidation by preloading and Sand drains; Strengthening by granular columns, Stone columns; Lime columns; Compaction by vibro-floatation, Blasting and Dynamic consolidation; Improvement of deep strata of fine soils by vacuum dewatering, electro-osmosis, Ground freezing and Thermal stabilization; Use of admixtures, Grouting techniques and principles. Reinforced earth: Basic mechanism, Constituent materials and their selection, Applications of geo-synthetics; Retaining walls, Slopes, Roads, Erosion; Ground anchors and soil nailing; Problems and case histories.

Text/ Reference Books:

1. Design with Geosynthetics - R. M. Korner, Prentice Hall, New Jersy, 3rd Edition.
2. Ground Improvement Techniques - P. Purushothama Raj, Tata McGrawHill, New Delhi.
3. Ground Improvement Techniques – Nihar Ranjan Patra [VIKAS]
4. Principles of Foundation Engineering - B. M. Das, Thomson, Indian Edition.
5. Text Book on Engineering with Geotextiles - G. V. Rao and G. V. S. Rao, Tata McGraw Hill.
6. Geotextile Hand Book - T. S. Ingold and K. S. Miller, Thomas Telfrod, London.
7. Foundation Design Manual - N. V. Nayak, Dhanpat Rai and Sons, Delhi.

CE 1609 Advanced Foundation Design

UNIT I : Foundation Components-Components of foundation, Classification of foundation, Geotechnical Design Parameters.
UNIT II : Shallow Foundation in Clay- Footings in Clay; Bearing Capacity and Settlement, Design of Rafts in Clay, Floating raft-Design.
UNIT III : Shallow Foundation in Sand- Geotechnical Design of Isolated, Raft and Combined footing in Sand,
UNIT IV : Pile Foundations- Load transfer through Piles, Piles in Clay and Sand, Test load on Piles, Pile Driving Formulae, Analysis of pile groups in sand & clay, Laterally loaded and Battered pile.
UNIT V : Well Foundation-Types of well foundation, Grip length, Well sinking, Measures for Rectification of Tilts and Shift, Analysis for well.

UNIT VI: Foundations on Expansive Soils-Identification of Expansive Soils, Consequences of Swelling, Design of Foundations in Expansive soils, Modification of Expansive Soils.

Text/ Reference Books:
1. Tomilson: Foundation Design and Construction, Pitman.
2. J. E. Bowles: Foundation Analysis and Design, McGraw-Hill.
3. Swami Saran: Analysis and Design of Sub structure, oxford and IBH publishing company pvt.
4. Kaniraj: Design Aid in Soil Mechanics and Foundation Engineering, Tata McGraw-Hill
5. Kurian: Design of Foundation System, Narosa Publishing House

CE 1610 Earth and Retaining Structures

UNIT I : Earth and Rock Fill Dams-Types of Dams, Materials, Foundation.

UNIT II : Stability Analysis-Slope-Stability Analysis, Seepage through Earth dam with Different Sloping face, Requirement and Safety of Earth dams, Stability of Slopes under Different Conditions.

UNIT III : Design of Retaining Walls-Types of Retaining Walls, Design of Gravity, Cantilever and Counterfort Retaining walls.

UNIT IV : Sheet Piles-Types of Sheet Piles, Design of Free Cantilever, Cantilever and Anchored Sheet Piles.

UNIT V: Braced Cuts and Coffer Dams-Sheeting and Bracing System, Design of Bracing, Types of Coffer Dams, Design of Coffer Dams in Soil.

UNIT VI: Shaft, Tunnels and Underground Conduits-Stresses in Soil around Shaft and Tunnels, Design of Underground Conduits; Ditch, Positive Projected, Negative Projected, Imperfect and Tunneled Conduits.

Text/ Reference Books:

1. Sherard: Earth and Rockfill Dams, J. Wiley and Sons
2. Bharat Singh and Sharma: Earth and Rockfill Dams, Sarita Prakashan.
3. V.N. S. Murthy: Soil Mechanics and Foundation Engineering, CBS Publishers & Distributors Pvt Ltd.
4. Christian Kutzner: Earth and Rockfill Dams, Taylor & Francis
5. Robert B. Jansen: Advanced dam engineering for design, construction, and rehabilitation, Springer

CE 1611 Soil Dynamics and Machine Foundation

UNIT I: Earthquake and its Effect-Introduction. Site seismicity, Seismic soil response, Design earthquake parameters.
UNIT II: Vibrations-Elementary vibrations, Free & Forced vibration with and without damping of single degree freedom system, Two degree freedom system.
UNIT III: Dynamic Soil Properties-Properties of Soil and its Evaluation, Behavior of Soil Properties due to Dynamic loads.
UNIT IV: Liquefaction-Mechanism of Liquefaction, Liquefaction factors, Evaluation of Liquefaction, Anti-liquefaction measures.
UNIT V: Dynamic Earth Pressure-Nature and Magnitude of Earth Pressure, Modified Coulomb's Theory of Earth Pressure, Modified Culmann's Graphical Earth Pressure.
UNIT VI: Dynamic Bearing Capacity-Bearing capacity, Settlement, Tilt and horizontal displacement of shallow foundations under dynamic load.

Text/ Reference Books:

1. Shamsher Prakash: Soil Dynamics, McGraw-Hill
2. Barkan: Soil Dynamics, McGraw-Hill
3. S.L. Kramer: Geotechnical Earthquake Engineering, Pearson Education

CE 1612 Traffic Safety and Assessment

UNIT 01 Introduction: Road traffic accidents scenario in India, characteristics of accidents, accident vs. crash, effect of human factors, planning for road network, land use and road environment for safety, designing for road safety – links and junctions, road safety engineering, road safety improvement strategies, elements of a road safety plan.

UNIT 02 Crash investigation and analysis: Steps in treatment of crash locations, diagnosing crash problem and solutions, accident report form, storing of data, using and interpreting crash data, identifying and prioritizing hazardous locations, condition and collision diagrams; Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled; Crash reconstruction: understanding basic physics, calculation of speed for various skid, friction, drag, and acceleration scenarios.

UNIT 03 Statistical analysis of accidents: Descriptive statistics, confidence interval, hypothesis testing, models related to accident frequency, accident severity, accident duration, various

methodological issues – over/under dispersion, time-varying explanatory variables, unobserved heterogeneity, endogeneity, under-reporting, spatial and temporal correlation, etc; Accident prediction model.

UNIT 04 Before -after methods in crash analysis: Before and after study, before and after study with control sites, comparative parallel study, before, during and after study, Empirical Bayes method. 04

UNIT 05 Road safety audits: Procedure, aims and objectives, roles and responsibility, history of road safety audit, design standards, tasks, various stages of safety audits; common identifiable problems, structuring of report, identifying common problems.

Text/ Reference Books:

1. "Measuring and Improving Infrastructure Performance," National Academy Press, Washington DC 1995
2. Grigg, Neil, "Infrastructure engineering and management," Wiley, 1988. (On reserve in library)
3. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, 1994.
4. Hudson, Haas, Uddin, Infrastructure management : integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, 1997. (On reserve in library)
5. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June 1990. (On reserve in library)
6. World Development Report 1994: Infrastructure for Development
7. Chakroborty, P. and Das A.,Principles of Transportation Enineering, Prentice Hall of India, New Delhi 2003

CE 1613 Transportation System and Planning

UNIT I: Introduction -The fields of transportation system, Transportation system engineering, Transportation organizations. Role of Transportation, Social, Economical, Political and Environmental.

UNIT II: Transportation Planning Process-Elements of Transportation Planning, Goals and objectives, Identification of needs, generation of alternatives, evaluation of alternatives, Implementation of alternatives.

UNIT III: Land-Use Transportation System-Components of transportation system, Urban Transportation System, Landuse and Transportation, land-use forecasting and land-use plans, Lowry-type transportation/Land use model.

UNIT IV: Transportation Survey-Study area definition, Zoning, Home interview surveys, Road-side Interview surveys, Inventory of Transport Facilities, Inventory of Landuse and Economic Activities, Expansion of data from samples.

UNIT V: Travel Forecast and Trip Distribution Models- Overview of Forecasting Process, Urban Activity Forecast, Trip Generation Models, multiple linear regression analysis, Category analysis methods of Trip Distribution: Uniform Factor method, Average Factor method, Frator method, Furnace method, Gravity models, Intervening Opportunity model, Destination Choice models, Entropy model.

UNIT VI: Mode Choice and Traffic Assignment Models -Logit models for mode choice, All or nothing assignment models, Incremental assignment models, user equilibrium models.

Text/ Reference Books:
1. Introduction to Transportation Engineering – William W Hay.
2. Introduction to Transportation Engineering Planning- E.K. Mortak.
3. Metropolitan Transportation Planning – J.K. Dickey
4. Priciples of Transportation Engineering- Partha Chakroborty and Animesh Das

Professional Elective – II   (3-0-0)

CE 1706 Water Supply Systems

Raw water Intake, screening, and aeration- types of intake structures, intake-site selection, intake design considerations, coarse screen or trash rack, fine screen, micro strainer, types of aeration and application of aeration.

Components of water distribution systems, Hydraulics of pipelines and pipe networks- basic equations for study flow, pumps in pipe lines-pump characteristics, pipeline with pump, culverts, pipelines connecting reservoirs- pipes in series, pipes in parallel, three reservoir system; pipe network systems- conservation laws, network equations, network simulations-Hardy Cross pipe network problem, linear method of pipe network analysis, branching pipe lines, municipal water distribution system, unsteady flow, generalized pipe system simulation models using EPANET software.

Hydraulic transients in distribution system- steady state flow in a pipe, water hammer condition, wave speed and pressure, control of hydraulic transients.

Text/ Reference Books:

1. Syed R. Qasim, Water Works Engineering, Ptrantice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. Ralph A. Wurbs, Water Resources Engineering, Ptrantice-Hall of India Pvt. Ltd., New Delhi, 2002.
3. Larry W. Mays, Water Resources Engineering, John Wiley & Sons, Inc., 2001.
4. Gurucharan Singh, Water Supply and Sanitary Engineering, Standard Publishers Distributors, New Delhi.

CE 1707 Remote Sensing and GIS Applications for Land and Water Resources

Physics of remote sensing: Electromagnetic spectrum, atmospheric effects, energy interaction with earth surface features. Platforms and remote sensing sensors: Photographic camera, scanners, earth resources satellites, active and passive microwave sensors. Digital image processing: Image rectification, image enhancement, image classification and accuracy. Image interpretation. Geographical Information System (GIS): Map data representation, geographic database concepts and analysis. Application of remote sensing and GIS in land and water resources system and evaluation.

Text/ Reference Books:

1. Lillisand and Keefer, Remote Sensing and Image Interpretation, John Wiley & Sons, 1979.
2. Balakrishnan, P., Issues in Water Resources development and management; the Role of Remote sensing, Indian Space Research Organization (ISRO-NNRMS-TR-67-86), Bangalore, 1986.
3. Robert G. Reeves, et al., Manual of Remote Sensing, Volume I & II (American Society of Photogrammetry, Fall Church, 1975.

CE 1708 Hydraullic Structures and Hydro Power Engineering

Advanced topics in design and construction of Gravity, earth and Rock-fill dams, Dynamic analysis of gravity dams. Spillways and energy dissipaters, Gates, Sluices, galleries, Contraction joints, Seepage control measures, Principles of foundation treatment. Transients in water conductor systems. Design of hydropower installation components intake structures, water conductor systems, tunnels, surge-tanks, penstocks, valves and anchor-blocks. Types of powerhouse. Underground, Semi-Underground. Turbines and their foundations. Introduction to structural and geotechnical aspects of powerhouse design.

Text/ Reference Books:

1. H. Rouse, Engineering Hydraulics, John Wiley and Sons
2. Varshney, Hydraullic and Irrigation Structures
3. K.R. Arora, Irrigation Water Power and Water Resources Engineering

CE 1709 Environmental Impact Assessment

Environmental impact assessment (EIA), definitions and concepts, rationale and historical development of EIA, EIA in Civil Engineering,Initial environmental examination, environmental impact statement, environmental appraisal, environmental impact factors and areas of consideration, measurement of environmental impact, organization, scope and methodologies of EIA, status of EIA in India;
Environmental management - principles, problems and strategies; Review of political, ecological and remedial actions; future strategies; multidisciplinary environmental strategies, the human, planning, decision-making and management dimensions;
Environmental audit, definitions and concepts, partial audit, compliance audit, methodologies and regulations; introduction to ISO and ISO 14000;
Life cycle assessment; Triple bottom line approach; Industrial Ecology; Ecological foot printing; Carbon trading; Sustainable development.

Text/ Reference Books:

1. Canter, R.L., "Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1996.
2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

3. John G. Rau and David C Hooten "Environmental Impact Analysis Handbook", McGraw Hill Book Company, 1990.
4. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.
5. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.

CE 1710 Computational Intelligence for Hydro Systems

Advanced Computing techniques - Computer methods in water resources - Solution to ordinary and partial differential equation using Finite difference and Method of Characteristics- Numerical integration and differentiation Design of digital models - Visual programming - Graphical user interface - Interactive model concepts.

Artificial intelligence - Heuristic search - Principle of Artificial Neural Network (ANN) - Application of ANN Model to Hydrology and Crop Water Requirement model. Fuzzy Logic concepts and Applications – Genetic Algorithms-Heuristic Optimization techniques.

Digital data management **-** Data base structure - Data acquisition - Data warehouse - Data retrieval-Data format Attribute - RDBMS - Data analysis - Network data sharing - Statistical Analysis (SYSTAT) - Regression - factor analysis - histogram - scatter diagram - Goodness of fit.

Simulation software in water resources- Surface water models (HMS) - Storm Water Management Models (SWMM) –culvert hydraulic design(HY) – River Analysis system models (HEC-RAS)- MIKE 11, MIKE 21, MIKE FLOOD, MIKE BASIN,MIKESHE model applications –Ground Water Flow models (MODFLOW) – Groundwater transport models.

Simulation models in irrigation water management **-** Soil water assessment simulation models (SWAT) - Basin simulation models (MITSIM, VASIM) -Real time operation models - Water Resources Information System, Management Information System. Decision support system for Irrigation management.

Text/ Reference Books:

1. Aliev R. A, and Aliev Rashad Soft Computing and its Applications World Scientific Publications Co. Pte. Ltd. Singapore, 2001.
2. Janusz Kacprzyk Applied Decision with Soft Computing Springer, 2003
3. Carlos A. Coello Coello, David A Van Veldhuizen, Gary B Lamont, Evolutionary Algorthms for Solving Multi-objective problems, Springer, 2002.
4. Tayfur Gökmen Soft computing in water resources engineering, WIT Press, Great Britain,UK,20124.
5. John E. Gribbin, Introduction to hydraulics and hydrology with applications for Storm water Management. DELMAR, Thomson Learning, USA,2002.
6. Remson I, Hornberger G.M. and Moiz F.J., Numerical methods in Sub- Surface Hydrology. Wiley Inter Science, 1985

7. Kazda, I., Finite element Techniques in ground water flow studies (with Applications in Hydraulic and Geotechnical Engineering), Elsevier, 1990.
8. Abbott M.B, and Minns A.W. Computational hydraulics Ashgate, London, UK, 2007.
9. Loucks Daniel P., Jery R Stedinger and Douglas, A. Haith, Water Resources systems Planning and Analysis. Prentice Hall Inc., Englewood Clifts, New Jersey, 1981.

CE 1711 Embankment Dam Engineering

Introduction, Investigation of dam sites, Types and advantages of embankment dams, Factors affecting the design of embankment dams, Design concept, Treatment of foundation for embankment dams, Grouting, Materials for construction, Safety criteria, Theoretical analysis of seepage through embankment dams (with filter and without filter) and its application, flow nets in dams, Seepage control, Anti-seepage elements (Active and Passive), Stability analysis including seismic stability, Failure of embankment dams, Typical problems and their solutions in embankment dams, Hydraulic and semi hydraulic fill dams, Rockfill dams, Head race canal and Hydraulic turbine.

Text/ Reference Books:

1. Engineering for Embankment Dams - Bharat Singh.
2. Engineering for Dams [Vol. I, II & III] - Creager, Justin & Hinds.
3. Dam Engineering - J. L. Sherad & et.al.
4. River and Canal Levees – P. Peter, Elsevier Publishing.

Professional Elective – III (3-0-0)

CE 1804 Bridge Engineering

UNIT -I: Brief historical review, Different types of Bridges and span range, Bridge codes, Bridge supper structures-Reinforced concrete slab bridge decks,

UNIT -II: Orthotropic plate theory, Determination of rigidity parameters, load distribution and different girders-courbon's method, morice-little method: design principles of Tee- beam and slab bridge deck.
UNIT -III: Brief introduction and design principles of plate girder bridges, composite bridges,

UNIT IV: prestressed concrete bridges, steel trussed bridges, cable stayed and suspension bridges, Bridge construction; Bridge maintenance.

UNIT -V: Types of tunnel, lined and unlined tunnels: Survey and exploration, planning of tunnels, Stresses in tunnel, tunnel shapes, usages

UNIT -VI: Tunneling methods, various construction techniques of tunnel in soil and rock, problems associated with tunnel and case studies.

Text/ Reference Books:

1. S Ponnuswamy, "Bridge Engineering" Tata McGrwa-Hill Pub.
2. S.P.Bindra, "Element of Bridge Tunnel & Railway Engineerings", Dhanpat Rai Pub. India.
3. S.P.Bindra, "Principles and Practice of Bridge Engineering", Dhanpat Rai Pub. India.

CE 1805 Theory of Elasticity

UNIT 1: Fundamentals of Elasticity Theory- Fundamentals of Elasticity Theory: The requirements for a solution, solution procedures, the St. Venant's principle, Stress functions.

UNIT 2: Elasticity Theory for Beams- Beams: Some exact solutions for the bending of beams. Beams of irregular crosssection, Curved beams.

UNIT 3: Stress Concentration and Fracture Mechanics-Concentrated Loads and Stress Concentrations, Fracture Mechanics : Stress distributions due to cracks, & Fracture.

UNIT 4: Variational and Energy Methods-Variational and Energy Methods. Numerical Methods.

UNIT 5: Constitutive Stress-Strain Relations-Theory and Deformation Theory, Generalized stress-strain relations, Bending and torsion of prismatic bars, Ax symmetric problems. Metal forming processes.

Text/ Reference Books:
1. Theory of Elasticity – Timoshenko & Goodier, Tata Mcgraw Hill.
2. Theory of Elasticity – L. D. Landau, A. M. Kosevich, E. M. Lifshitz, Butterworth-heinemann.
3. Theoretical Elasticity – A. E. Green & W. Zerna, Dover Publications
4. Elasticity – M. H. Saad, Elsevier.
5. Advanced Strength and Applied Elasticity – Ugural & Fenster, Prentice Hall. •
6. Elasticity – J. R. Barbar, springer.

CE 1806 Finite Element Method

Finite element techniques, discretization, energy and variational approaches, basic theory, displacement, force and hybrid models, shape function theory, use of parametric and local coordinates, convergence criteria, numerical integration. Element formulation, 2-D elements, plate-bending elements, introduction to 3-D elements, shell elements, interface elements, boundary elements, infinite elements. Applications, plain stress and plain strain problems, axisymmetric solids, plate and shell structures, and temperature and flow problems, non-linear problems, introduction to iterative and incremental procedures for material and geometrically non-linear problems, examples from plain stress and stability. Programming, organization of FEM programme, efficient solver, input/output, plotting and mesh generation aspects, pre and post-processors with graphic package for FEM, time dependent problems by explicit and implicit schemes.

Text/ Reference Books:
1. 1.R Dhanraj & Prabhakaran Nair, Finite Element Methods, Oxford University Press, 2007, New Delhi.
2. J.N. Reddy, An Introduction to Nonlinear Finite Element Analysis, Oxford University Press, 2007, New Delhi.
3. R. D. Cook, Concepts and Applications of Finite Element Analysis, John Wiley& Sons, New York
4. C. S. Krishnamoorthy, Finite Element analysis-Theory and Programming, Tata McGraw Hill.
5. O. C. Zienkiewicz and R. L. Taylor, The Finite Element Method, McGraw Hill Publishing Company
6. M. Petyt, Introduction to finite element vibration analysis, Cambridge University Press, UK.
7. T. R. Chandrupatla & A. D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall of India, Pvt. Ltd., New Delhi.

CE 1807 Construction Safety and Fire Engineering

UNIT I : Introduction to Construction Industry and Safety: Basic concepts – accident – injury –lost time accidents, reportable accident, frequency rate, severity rate, incidence rate.

Technological, Organization and Behavioral Aspects of safety in construction, Human factors that are Impediments to safety in construction, Roles of different groups in ensuring safety,

health, welfare and social security, Steps to be taken in construction sites in case of accidents, Introduction to ergonomics and its relevance to construction.

UNIT II : Safety in various construction operations such as soil excavation, rock blasting, dewatering, piling, demolition, working at heights -ladders and scaffolds, working in confined spaces, Safety in electrical works at construction site.

UNIT III : Safety in storage, stacking and handling of construction materials-cement, lime, aggregates, bricks and blocks, steel, glass, paint and varnish, flammable and hazardous materials used at sites. Safety in the operation of construction equipments- excavators, trucks, tower cranes, mobile cranes, lifting tackles, chain and pulley, Personal protective equipment's for construction.

UNIT IV : Classification of fire. Effect of high temperature on the properties of concrete, steel, masonry, wood, Fire damage to concrete, steel, masonry and timber, Repair techniques to the fire damaged reinforced concrete columns, beams, slabs and to the steel structural members.

UNIT V: Design principles of fire resistant walls. Classification of buildings based on occupancy, types of construction as per National Building code of India; Fire zones; General Requirements of fire protection for all individual occupancies.

UNIT VI: Life safety aspects of building fires – Exit Requirements as per NBC of India. Requirements other than general requirements for buildings of different occupancy classification.

Text/ Reference Books:

1. Vaid, K. N. Construction Safety Management.
2. Smith and Harmathy. Design of Buildings for Fire Safety.
3. Linger, L. Modern Methods of Material Hand ling.
4. Merchant, E. W. A Complete Guide to Fire and Buildings.
5. Jain, V. K. Fire Safety in Buildings. New Age International (p) Ltd., New Delhi.

CE 1808 Advanced Concrete Design

Estimation of crack width and deflection of reinforced concrete beams. Analysis and design of building frames Subjected to wind load; Earthquake forces and structural response. Ductile detailing of RCC frames, Design of beam-column joints, Design of deep beam. Design of shear walls

Text/ Reference Books:

1. N Subramanian: Design of Reinforced Concrete Structures, Oxford University Press.

2. R. Park and T. Pauley, Reinforced concrete structures, John Wiley and sons.
3. A. K. Jain, Reinforced Concrete: Limit State design, Nem Chand and Bros. 1999.
4. J. Krishna and OP Jain, Plain and Reinforced Concrete, Vol. I I, Roorkee, Nem Chand and Bros.
5. H. Nilson, D. Darwin and C. W. Dolar, Design of Concrete structures, Tata McGraw Hill
6. T. Paulay and M.J.N. Priestley , Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons Inc.

CE 1809 Offshore Structures

Unit I
Introduction to different types of offshore structures, Concept of fixed, compliant and floating structures, Law of floatation, fluid pressure and centre of pressure, estimation of centre of gravity, hydrostatic particulars, stability criteria of floating bodies, and motions of a floating body.

Unit II
Conservation mass and momentum, Euler equation, Bernoullis Equation, Potential flow, Classification of waves, small amplitude or Linear Airy's theory, dispersion relationship, water particle kinematics, wave energy.

Unit III
Wave force estimation- Wave force on small bodies-Morison equation, Estimation of wave force on a vertical cylinder, Force due to current, Effect of marine growth on vertical cylinders.

Unit IV
Wave force on large bodies-Froude-krylov theory

Unit V
Mathematical modelling of fixed structure, Static and dynamic analysis of fixed offshore structures

References

1. Hand book of offshore Engineering, Vol I, Subrata Chakrabarti, Offshore Structure Analysis, Inc., Plainfield, Illinois, USA.
2. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
3. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
4. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.
5. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.

Professional Elective – IV   (3-0-0)

CE 1810 Port and Harbour Engineering

Unit I

Introduction on different types of port and harbour structures- Breakwaters, Jetties, Wharves, Quays, berthing structures, Diaphragm Walls, Slipways, Docks. Types of breakwaters, types of berthing structures, Types of fenders, Vessel type and size.

Unit II

Site Characteristics, Bathymetry survey, Wave rose diagram, Design of break water, Dredging methods and disposal

Unit III

Estimation of different types of loads-berthing force, mooring force and seismic force, active and passive earth pressure, differential water pressure, Load combinations and codal provisions on port and harbour structures, Analysis of jetties, wharves, quays and berthing structures, break waters, docks. Construction of port structures.

Unit IV

Soil Structure interaction, Fixity depth, Analysis of pile with spring support, Offshore terminals, fenders and mooring facilities, Limit state and working stress design methods, crack width calculation.

Unit V

Pile load tests, ground improvement techniques, construction methodology, Foundation for berthing structures, design of piles for berthing structures, BOQ and cost estimation.

Text/ References Books:

1. Port Engineering, Zhou Liu and Hans F. Burcharth, Laboratoriet for Hydraulik og Havnebygning, Alborg Universitet.
2. Port Design - Guidelines and recommendations by C. A. Thoresen, Tapir Publications.
3. Design of Marine Facilities for the Berthing, Mooring and Repair of Vessels by J. W. Gaythwaite, Van Nostrand.
4. Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.

5. Agerschou, H., Lundgren, H., Sorensen, T., Ernst, T., Korsgaard, J., Schmidt, L.R. and Chi, W.K., (1983). "Planning and Design of Ports and Marine Terminals", A Wiley-Interscience Publication.
6. Per brun (1983). "Port Engineering" Gulf Publishing Co.

CE 1811 Disaster Management

UNIT I : Introduction - Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation.

UNIT II :Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III : Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climatechange and urban disasters.

UNIT IV: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V*: Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmentalfriendly recovery; reconstruction and development methods.

Text / Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management ,APH Publishing Corporation.

CE 1812 High Rise Structures

Analysis of tall building frames, Lateral load analysis, multi bay frames, gravity loads, settlement of foundation. Analysis of shear walls - plane shear walls, infilled frames, coupled frames, frames with shear walls. Principle of three dimensional analysis of tall buildings; Perforated cores, pure torsion in thin tubes, bending and warping of perforated cores. Analysis of floor system in tall buildings, Vierendal girders, diagrid floors; Elastic and inelastic stability of frames and shear walls; Analysis of thermal stresses

Text/ Reference Books:

1. B S Smith & A Coull, Tall Building Structures: - John Wiley & Sons.
2. W. Schueller, High Rise Building Structures: John Wiley & Son.

CE 1813 Solid Waste Management

UNIT I: **SOURCES AND TYPES**
Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO's.

UNIT II : **ON-SITE STORAGE AND PROCESSING**
On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

UNIT III : **COLLECTION AND TRANSFER**
Methods of Residential and commercial waste collection – Collection vehicles – Manpower–
Collection routes – Analysis of collection systems; Transfer stations – Selection of
location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV : **OFF-SITE PROCESSING**
Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V : DISPOSAL

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor Dumpsite Rehabilitation

References:

1. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of UrbanDevelopment, New Delhi, 2000.
2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
3. Manser A.G.R. and Keeling A.A.," Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996
4. George Tchobanoglous and Frank Kreith"Handbook of Solidwaste Management", McGraw Hill, New York, 2002

CE 1814 Environmental Pollution and Control

UNIT – I : Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards.Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.

UNIT –II : Industrial wastewater Management: – Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

UNIT – III : Solid Waste Management: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

UNIT – IV : Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

UNIT – V: Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

UNIT- VI: Sustainable Development: Definition- elements of sustainable developments- Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability– Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable development.

References

1. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elesevier, 2003.
2. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.
3. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing

CE 1815 Traffic Engineering

UNIT I: Introduction To Traffic Engineering-Definition and Scope of Traffic Engineering, Functions, Organization and Importance of Traffic Engineering. Elements of Traffic Engineering: Vehicular, Driver and Road Characteristics.

UNIT II: Traffic Flow Parameters -Traffic flow parameters: volume, density, speed and related terms, Relationship between various parameters, Study and analysis of vehicle arrivals, headways, and gap acceptance in traffic flow. Highway Capacity and Level of Service.

UNIT III: Traffic Flow Theory-Fundamental diagrams of traffic flow theory, Macroscopic traffic flow models: Green Shield's model and Greenberg model, Calibration of macroscopic models. Microscopic traffic flow models: Lighthill and Whitham's Theory, Car Following theory. Shock waves, Queuing theory and its practical applications in traffic engineering problems.

UNIT IV: Traffic Studies-Traffic survey: Speed studies, journey time and delay studies; traffic volume studies, vehicle classified count and occupancy; origin-destination studies, parking studies.

UNIT V: Traffic Analysis-Traffic Analysis: Statistics and its applications in analysis of traffic data: Probability, Mean, Variance, and Standard Deviation; Poisson, Binomial and Normal distributions, Significance Testing; Linear and Multiple Regression; and Correlation.

UNIT VI: Traffic Control-Definition, functions and importance of traffic control. Methods of traffic control: Traffic signs, Road Markings, and other traffic controls aids. Traffic Regulation. Intersection control and design of traffic signals.

Text/ Reference Books:

1. Traffic Engineering by L.R. Kadiyali , Khanna Publishers.

2. Highway Engg by S.K. Khanna and C.E.J. Justo, Nem Chand Publication
3. Principles of Transportation Engineering by P. Chakravorhy and Animesh Das, PHI Learning Private Limited.
4. Transportation Engineering: An Introduction by C. Jotin Khisty, B. Kent Lall, PHI Learning.

CE 1816 Rock Engineering

UNIT I: Rock Engineering-Rock Mechanics, Different types of Rocks, Stress and Infinitesimal strain.
UNIT II : Classification of Rock and Rock Masses-Engineering classification of rocks and rock masses. Strength and Modulus from Classifications.
UNIT III: Rock Strength and Deformability-Rock strength and failure criteria, Intact rock and rock masses properties, initial stresses in rock and their measurements, Stress-Strain models.
UNIT IV: Rock Foundation-Estimation of Bearing Capacity in Intact and Fractured Rocks, Bearing Capacity of Pile / Pier in Rocks.
UNIT V: Drilling and Blasting For Underground and Open Excavations-Operational Planning, Explosive Materials, Blast Design, Controlled Blasting Techniques.
UNIT VI: Shotcreting- Shortcrete; Purpose, Methods, Mix Design and Testing.

Text/ Reference Books:

1. B. Singh and R.K. Goel: Rock Mass Classification, Elsevier.
2. Brady and E.T. Brown: Rock Mechanics for Underground Mining, George Allen & Unwin (Publishers) Limited.
3. Vutukuri, Lama and Saluja: Handbook on Mechanical Properties of Rock, Trans Tech Publications.
4. E. Hoek and J. Bray: Rock Slope Engineering, Taylor and Francis

CE 1814   Projects and Seminar   0-0-8

Open Elective-I

S.No.	Subject Code	Subject Name
1	CE 1712	Planning for Sustainable Development
2	CE 1713	Project Management

Open Elective-II

S.No.	Subject Code	Subject Name
1	CE 1817	Rural Technology & Community Development

Open Elective-I (3-1-0)

CE 1712   Planning for Sustainable Development

UNIT I: Sustainable Development-explains and critically evaluates the concept of sustainable development, Environmental degradation and poverty Sustainable development: its main principles, the evolution of ideas about sustainability, strategies for promoting sustainable development, resistances to the concept, and some alternative approaches. Examine some important current issues and areas of debate in relation to sustainable development.

UNIT II: Innovation for sustainable development- Environmental management and innovation strategies.

UNIT III: Societal transformations. Institutional theory.

UNIT IV: Governance for sustainable development. Policy responses to environmental degradation.

UNIT V: Capacity development for innovation. Research methods.

Text/Reference Books:

1. Harris, J.M. (2204) Basic Principles for Sustainable Development, Global Development and Environment Institute, working paper 00-04. Available at: http://ase.tufts.edu/gdae/publications/Working_Papers/Sustainable%20Development.PDF
2. Robinson, J. (2004) Squaring the circle? Some thoughts on the idea of sustainable development Ecological Economics 48(4): 369-384.
3. Hjorth, P. and A. Bagheri (2006) Navigating towards Sustainable Development: A System Dynamics Approach, Futures 38: 74-92.

4. Mog, J.M. (2004) „Struggling with Sustainability – A Comparative Framework for Evaluating Sustainable Development Programs", World Development 32(12): 2139–2160. IISD Commentary on the OECD's Draft Principles for International Investor Participation in Infrastructure (PDF – 68 kb)
5. Arundel, A., R. Kemp, and S. Parto (2004) Indicators for Environmental Innovation: What and How to Measure, forthcoming in International Handbook on Environment and Technology Management (ETM), edited by D. Annandale, J. Phillimore and D. Marinova, Cheltenham and Edward Elgar.

CE 1713 Project Management

UNIT I: Introduction to Project management**:** Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.

UNIT II: Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks.

UNIT III: Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.

UNIT IV: Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management.

UNIT V: Post-Project Analysis.

Text/Reference Books:

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation,
2. Prentice Hall, India
3. Lock, Gower, Project Management Handbook.
4. Cleland and King, VNR Project Management Handbook.
5. Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. Ibdia
6. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
7. S. Choudhury, Project Scheduling and Monitoring in Practice.
8. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd

Open Elective-II (3-1-0)

CE 1811 Disaster Management

UNIT I : Introduction - Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation.

UNIT II :Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III : Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climatechange and urban disasters.

UNIT IV: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V*:* Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmentalfriendly recovery; reconstruction and development methods.

Text / Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management ,APH Publishing Corporation.

CE 1817 Rural Technology & Community Development

UNIT I: Data Analysis and Measures of Central Tendency- Meaning, nature, scope and limitations of statistics, collection of statistical data, classification, tabulation and diagrammatic representation of data, Measures of central tendency : Statistical averages Mean, Median, Mode.

UNIT II: Data, Information and Knowledge; concept of information, need of information (professional, educational, research), qualities of information, value of information, difference between data and information, properties of the needed information. Information and Management; planning, organizing, co-ordinating and controlling,

UNIT III: Concepts of marketing; difference between marketing selling and retailing; marketing mix, market-segmentation, marketing planning. Strategy and Approaches; modern concept of marketing.

UNIT IV: Community development; concept, definition, meaning, need, history, principles, objectives and scope. Community Building: Coming of Age, Regenerating Community, Community Model.

UNIT V: Consensus Organizing Model, What's Behind Building Healthy Communities? Participatory Democracy, The Role of various NGOs in Community Development. The Role of Business and Government in Community Development Initiatives How to Form a Nonprofit Corporation Fund Raising and Grant Writing.

Text/Reference Books:

1. Biddle, William Wishart. 1968. Encouraging Community Development: A Training Guide for Local Workers. New York: Holt, Rinehart and Winston.
2. Clark, Kenneth B. and Jeannette Hopkins, eds. 1969. A Relevant War Against Poverty: A Study of Community Action Programs and Observable Social Change. New York: Harper and Row.
3. Clinard, Marshall Barron. 1970. Slums and Community Development: Experiments in Self-Help. New York: Free Press.
4. Creevey, Lucy E., ed. 1986. Women Farmers in Africa: Rural Development in Mali and the Sahel. Syracuse, NY: Syracuse University Press.
5. Dobyns, Henry F., Paul L. Doughty, and Harold D. Lasswell, eds. 1971. Peasants, Power, and Applied Social Change: Vicos as a Model. Beverly Hills, CA: Sage.
6. Edwards, Allen David and Dorothy G. Jones. 1976. Community and Community Development. The Hague, Netherlands: Mouton.
7. Green, Tova and Peter Woodrow. 1994. Insight and Action: How to Discover and Support a Life of Integrity and Commitment to Change. Philadelphia, PA: New Society Publishers.

8. Heskin, Allen David. 1991. The Struggle for Community. Boulder, CO: West view Press.
9. Kramer, Ralph M. and Harry Specht. 1975. Readings in Community Organization Practice. 2nd ed. Englewood Cliffs, NJ: Prentice-Hall.
10. Lean, Mary. 1995. Bread, Bricks, and Belief: Communities in Charge of Their Future. West Hartford, CT: Kumarian Press.
11. Sustainable Rural Technology, by M.S. Virdi, Daya Publishing House, ISBN: 8170355656
12. Rural Technology, (Paperback, Egnlish), by Punia Rd Roy, Publisher: Satya Prakashan (2009)
13. Rural Education And Technology, by S B Verma S K Jiloka Kannaki Das, Publisher: Deep & Deep Publications Pvt. Ltd. (2006)

(Prof. N. Dhang)   (Prof. D. Sen)   (Prof. S. P. Singh)   (Er. Subin Kumar)

(Sri Ashok Kumar)   (Sri S. K. Paswan)   (Dr. Ch. M. S. Rao)   (Dr. S. R. Pandey)

(Dr. A. K. Sinha)   (Dr. V. Kumar)   (Dr. P. Prasad)   (Dr. Sanjay Kumar)

(Sri N. Prakash)   (Dr. A.K. Singh)   (Dr. B. K. Prasad)   (Prof. A. K. Chaudhary)

(Prof. A. K. L. Srivastava)   (Prof. A. K. Khan)   (Prof. M. M. Prasad)   (Dr. R. P. Singh)