CIVIL ENGINEERING

3rd Semester

Course No.	Course Name	L-T-P-C
MA 201	Mathematics III	3-0-0-6
CE 201	Solid Mechanics	3-1-0-8
CE 203	Engineering Geology	3-0-0-6
CE 205	Civil Engineering Materials	3-0-0-6
CE 207	Surveying	3-0-0-6
CE 231	Civil Engineering Materials Lab	0-0-3-3
CE 235	Surveying Laboratory	0-0-3-3
CE 233	Building Drawing and CAD lab.	1-0-2-4
SA 201	NCC/NSS/NSO I	0-0-2-0
	Total Credits	**16-1-8-42**

4th Semester

Course No.	Course Name	L-T-P-C
MA 2xx	Numerical Methods	3-0-0-6
CE 202	Structural Analysis I	3-1-0-8
CE 204	Environmental Engineering I	3-0-0-6
CE 206	Geotechnical Engineering I	3-0-0-6
CE 208	Hydrology and Water Resources Engineering	3-0-0-6
CE 232	Environmental Engineering Lab	0-0-3-3
CE 234	Geotechnical Engineering I Laboratory	0-0-3-3
SA 202	NCC/NSS/NSO II	0-0-2-0
	Total Credits	**15-1-6-38**

5th Semester

Course No.	Course Name	L-T-P-C
CE 301	Structural Analysis II	3-1-0-8
CE 303	Environmental Engineering II	3-0-0-6
CE 305	Geotechnical Engineering II	3-0-0-6
CE 307	Fluid Mechanics	3-0-0-6
CE 309	Reinforced Concrete Design	3-0-0-6
CE 331	Geotechnical Engineering II Laboratory	0-0-3-3
CE 333	Fluid Mechanics Laboratory	0-0-3-3
	Total Credits	**15-1-6-38**

6th Semester

Course No.	Course Name	L-T-P-C
HS XXX	HSS II	2-0-0-4
CE 302	Transportation Engineering I	3-0-0-6
CE 304	Construction Technology and Management	3-0-0-6
CE 306	Design of Steel Structures	3-1-0-8
CE 308	Hydraulics and Hydraulic Structures	3-0-0-6
CE 332	Transportation Engineering I Laboratory	0-0-3-3
CE 334	Hydraulics and Hydraulic Structures Lab	0-0-3-3
	Total Credits	**15-1-6-36**

7th Semester

Course No.	Course Name	L-T-P-C
HS xx	HSS III	2-0-0-4
CE 401	Transportation Engineering II	3-0-0-6
CE 4xx	Departmental Elective I	3-0-0-6
CE 4xx	Departmental Elective II	3-0-0-6
XX 4xx	Open Elective I	3-0-0-6
CE 431	Computational lab.	0-0-3-3
	Total Credits	**14-0-3-31**

8th Semester

Course No.	Course Name	L-T-P-C
CE xxx	Departmental Elective III	3-0-0-6
CE xxx	Departmental Elective IV	3-0-0-6
HS 4xx	Open Elective II	3-0-0-6
CE 432	Project	0-0-9-9
	Total Credits	**9-0-9-27**

Total Credits (excluding 1st year): 212
SYLLABUS

CE 101 ENVIRONMENTAL STUDIES (2-0-0-4)

Water Pollution: Water quality, physical, chemical & biological characteristics of water & waste water, ground water pollution, water borne diseases.

Air & Noise Pollution: Primary & secondary air pollutants, sources, effects & control of- carbon monoxide, nitrogen oxides, hydrocarbons, sulphur dioxide & particulates, Air quality standards, global warming, acid rain, El Nino, ozone hole. Classification and measurement of noise, effects of noise pollution on human, control of noise pollution.

Energy & Solid Waste Management: Conventional energy resources- coal, thermal, petroleum, hydroelectricity, nuclear power, wood, non conventional sources- solar, biogas, wind, ocean & tidal energy, geothermal energy. Hazardous and non hazardous solid waste management. Environmental laws and acts.

Disaster Management
Elements of Engineering Seismology: Earthquake Occurrence in the world, causes, Plate tectonics, Earthquake mechanism, seismic zoning map of India and its use.
Earthquake phenomenon: Focus, epicenter, seismic waves, magnitude, intensity scale its co-relation with ground acceleration. Guide lines on construction Earthquake resistant Houses, Seismic Hazard assessment and do's for protection of life and property during disaster. Land slide :- Geo-technical aspect of landslides and control of Landslide Hazard. Flood :- Flood Control as a measure of Disaster management and Mitigation. Cyclone and Fire :- Cyclone Disaster Mitigation and ensuring wind and fire hazard safety during disaster.

TEXT BOOKS:
1. Rana. S.V.S., ?Essentials of Ecology & Environment Science, PHI Publications.
2. Basak Anindita, ?Environmental Studies?, Pearson Education South Asia.

REFERENCE BOOKS:
1. Subramanian. V, ?A Text Book of Environmental Science?, Narosa Publishing House.
2. De Anil Kumar & De Arnab Kumar, ?Environmental Studies?, New Age International (P) Ltd.
1. Narayan, Disaster Management, APH Publishing Corporation

2. Murthy, Disaster Management, Deep & Deep
3. Nijuj Kumar, Disaster Management, Alfa Publication

CE 201 SOLID MECHANICS (3-1-0-8)

Force Transmission and Deformation, continuum, isotropy, homogeneity, conservation of linear momentum, angular momentum and mass, Cauchy Axiom and definition of stress tensor, equation of equilibrium, Principal stress and Principal plane, Strain at a Point: Displacement of a point and relative displacement of line segments, Green Lagrange strain tensor and small strain tensor, Compatibility requirements, Constitutive relations, Relationships between various material constants for linear elastic materials, Boundary Value Problems, Energy Formulation for deformable body: Principle of minimum potential energy, Virtual work method, Failure criteria for materials, Uniaxial tension in bar, thermal stresses. Torsion of right circular section and non-circular section, Bending of Beams, bending moment and shear force diagrams, Stresses due to shear, Shear center, Deflection of beams, Buckling of Columns: Euler's formula, different end conditions and effective length, energy method.

Texts:
1. S.M.A. Kazimi, Solid mechanics, Tata McGraw Hill, First revised edition, 2006.
2. E. P. Popov, Engineering Mechanics of Solids, Dorling Kindersley (India) Pvt Ltd, 2nd edition, 2006.

References:
1. L. S. Srinath, Advanced Solid Mechanics, Second Edition, Tata McGraw Hill, 2003.
2. J.M. Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, 2000.
3. J. M. Gere and S. P. Timoshenko, Mechanics of Materials, CBS Publisher, 4th edition, 1996.

CE 203 ENGINEERING GEOLOGY (3-0-0-6)

The Earth: a system approach; Earth Processes and their consequences: Lithosphere, Hydrosphere, Cryosphere, Atmosphere, Biosphere and interconnectedness; Earth Materials: rocks, soils, minerals; Engineering and Genetic classification of rocks; Rock mechanics; Strength Properties of Rocks: Rock Mass Strength; Weathering; Structures: Folds, Faults, Joints; Plate Tectonics, Earthquakes: Causes, classification, magnitude, intensity, seismic hazards zoning;; Groundwater: resources and quality; Site Investigation: S. I. Desk Study; Remote sensing, GIS and GPS: Basic principles and applications, Boreholes; Landslides and Subsidence: causes, classification and monitoring; Rock excavation: Cut Slopes in rocks; Criteria and factors for site selection for dams, tunnels, waste/radioactive disposal sites.

Texts:
1. K V G K Gokhale, *Principles of Engineering Geology*. B S Publications, Hyderabad, First Edition, 2005.
2. A. C Waltham, *Foundations of Engineering Geology*, Blackie Academic & Professional, Chapman & Hall , First Edition, 1997.

References:
1. K. Allan, *General Geology for Engineers*, Second Edition, Prentice & Hall, 1995.
2. P. Kesavulu, *Engineering Geology*, Oxford University Press, Second Edition, 1999.
3. P. Singh, *Engineering and General Geology*, S. K. Kataria and Sons, Sixth Edition, 1999.

CE 205 CIVIL ENGINEERING MATERIALS (3-0-0-6)

Introduction to structures of solids, ductility, brittleness, strength, stiffness, durability, hardness, toughness; Weakness of materials, Introduction to building materials, Cement: Chemical composition, manufacturing, physical characteristics, hydration, properties of cement compounds, different types of cements, Aggregate: Coarse and fine aggregates, Influence of aggregate on the properties of concrete, aggregate selection. Fresh Concrete: Batching, Mixing, workability, effect of admixture, Hardened Concrete: mechanical properties of hardened concrete, Water cement ratio, Porosity, Curing of concrete, High performance concrete, Design of concrete mix: IS code recommendation, British code and ACI code, Brick: Raw materials, drying and burning, Strength and durability, mortar for masonry and strength of masonry, Timber, Seasoning and conversions, properties, tests, defects in timbers, Glass: Chemical compositions, mechanical and optical properties, Various types of glasses, Strengthening of glasses, Metals, steel for reinforced concrete and prestressed concrete

construction, structural steel sections, Deterioration of building materials: Corrosion, chloride and sulphate attack on concrete, alkali-aggregate reaction, acid aggregate reactions.

Texts:
1. S. Somayaji, *Civil Engineering Materials*, Prentice Hall, New Jersey, 2001.
2. M. S. Mamlouk and J. P. Zaniewski, *Materials for Civil and Construction Engineers*, Pearson, Prentice Hall, Second edition, 2006.

References:
1. M., Neville and J. J. Brooks, *Concrete Technology*, Pearson Education, Fourth Indian reprint, 2004.
2. N. Jackson and R. K. Dhir, *Civil Engineering materials*, Macmillan Fourth edition 1997.
3. M. S. Shetty, *Concrete Technology*, S. Chand and Company Ltd. 2005.
4. P. C. Aitcin, *High Performance Concrete*, E & Fn Spon, 1998.

CE 207 SURVEYING (3-0-0-6)

Introduction to surveying; linear measurements; chain surveying; compass surveying; accuracy, precision and errors, leveling; plane table; contouring, theodolite surveying, tacheomatric survey; trigonometrical surveying; triangulation; curves; advanced survey instruments; Electronic Distance Measurement, Total station and Global Positioning System, Introduction to photogram-metry and remote sensing.

Texts:
1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Vol-I and Vol-II, Pune Vidyarthi Griha Prakshan, 1972.
2. B. C. Punmia, A.K. Jain & A.K. Jain, Surveying, Vol-I and Vol-II, Laxmi Publication Pvt., 1996.

References:
1. T.M. Lillesand and R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley & Sons, 1994.
2. W. Schofield, Engineering Surveying, Butterworth, Heinemann, New Delhi, 2001.
3. G. Joseph, Fundamentals of Remote Sensing, Universities Press, 2003

CE 231 CIVIL ENGINEERING MATERIALS LAB (0-0-3-3)

Physical tests on cement, fine and coarse aggregate, tests for workability, tests on hardened concrete, compression tests on cubes and cylinders, modulus of rupture test, rebound hammer and UPV test, testing of bricks, efflorescence, water absorption and compressive strength, testing of reinforcement bar in tension.

Texts/ References:
1. M. S. Mamlouk and J. P. Zaniewski, *Materials for Civil and Construction Engineers*, Pearson, Prentice Hall, Second edition, 2006.
2. M., Neville and J. J. Brooks, *Concrete Technology*, Pearson Education, Fourth Indian reprint, 2004.
3. S. Somayaji, *Civil Engineering Materials*, Prentice Hall, New Jersey, 2001.
4. M. S. Shetty, *Concrete Technology*, S. Chand and Company Ltd. 2005.

CE 233 SURVEYING LAB (0-0-3-3)

The laboratory work will consist of experiments and office work based on the theory paper of Surveying.

CE 235 BUILDING DRAWING AND AUTOCAD LAB (1-0-2-4)

Drawing of Plan, Section and Elevation of Buildings - Line Diagram - Representation of Doors, Windows, Ventilators and Built in Features; Development of Plans for Single Storied and Multi Storied Buildings – Site Plan - Orientation;

Texts/ References:

1. Shaw, Kale and Patki - Building Drawing: with an Integrated Approach to Built Environment, McGraw Hill, 2002.

CE 202 STRUCTURE ANALYSIS I (3-1-0-8)

Different types of structures, Loads on the structural system, static and kinematic indeterminacy, Methods of Analysis: Equilibrium equations, compatibility requirements, Introduction to force and displacement methods, Analysis of trusses: plane truss, compound truss, complex truss and space truss, Arches and suspension cables, three hinged arches and suspension cables, Deflection of Beams, various methods for calculation of deflection, Analysis of indeterminate structures by force methods, flexibility coefficients, Energy methods: Principle of minimum potential energy, principle of virtual work, Castigliano's theorems, Reciprocal theorem, unit load method, Influence line and Rolling loads, beam, frames and arches, Muller- Breslau Principles and its applications to determinate and indeterminate structures.

Texts:
1. C.S. Reddy, *Basic Structural Analysis*, Second Edition, Tata McGraw Hill, 2005.
2. R.C. Hibbeler, *Structural Analysis*, Pearson Education, 6th edition, 2009.

References:
1. D.S. Prakash Rao, *Structural analysis: Unified approach*, Universities Press, 1996.
2. C.H. Norris, J.B. Wilbur, S.Utku, *Elementary Structural Analysis*, Tata McGraw Hill, 4th edition, 2003.
3. L. S. Negi and R. S. Jangjid, *Structural Analysis*, Tata Mc. Graw, New Delhi, 1997.

CE 204 ENVIRONMENTAL ENGINEERING I (3-0-0-6)

Introduction, Population Forecasting and Water Demand, Physical, Chemical and Biological Characteristics of Water and Wastewater, Wastewater Flow, Sewerage system and sewer design, Basic Microbiology: cells, classification and characteristics of living organisms. Metabolic Processes, Microorganisms in Natural Water Systems, Biological Oxidation of Organic Matter. Introduction to Environmental Chemistry, Stoichiometry and Kinetics of Chemical Reactions, Equilibrium Constant and Solubility Products, pH and Alkalinity. Development of Oxygen Sag Model. Flow sheets for Water and Wastewater Treatment, Introduction to Solid Waste, Air Pollution and Noise Pollution.

Texts:
1. H. S Peavy, D. R. Rowe and George Tchobanoglous, *Environmental Engineering*, McGraw-Hill International Ed., 1985.
2. T. J McGhee, *Water Supply and Sewerage*, McGraw-Hill Inc., 1991.

References:
1. M. L Davis and D. A Cornwell, *Introduction to Environmental Engineering*, McGraw-Hill, Inc.,1991.
2. Metcalf & Eddy*, Wastewater Engineering- Treatment and Reuse* (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata
McGraw Hill, 4th Edn., 2004.
1. C. N Sawyer, P. L McCarty and G. F. Parkin, *Chemistry for Environmental Engineers*, McGraw- Hill, 1994.
2. APHA, *Standard Methods Examination of Water and Wastewater*, American Public Health Association, Washington DC, 1995.

CE 206 GEOTECHNICAL ENGINEERING I (3-0-0-6)

Origin of soil, Phase relationships, Identification and classification of soils, Effective stress principle, Permeability of soils, Compressibility of soils, Seepage and flownets, Terzaghi's one-dimensional consolidation theory, Shear strength of soils, Effective stress and total stress strength parameters, Total and effective stress paths, Compaction of soils.

Texts:
1. Gopal Ranjan & A.S.R. Rao, *Basic and Applied Soil Mechanics*, New Age International, 2000.
2. K. Terzaghi, R. B. Peck and G. Mesri, *Soil Mechanics in Engineering Practice*, John Wiley & Sons, 1996.

References:
1. S.R. Kaniraj, Design Aids in Soil Mechanics & Foundation Engineering, Tata McGraw Hill, 1988.
2. T.W. Lambe and R.V. Whitman, *Soil Mechanics*, John Wiley & Sons, 1969.

CE 208 HYDROLOGY AND WATER RESOURCES ENGINEERING (3-0-0-6)

Surface water hydrology - hydrologic cycle, rainfall and its measurement, mean rainfall, runoff; Flow measurements; Infiltration losses; Storm hydrology; Unit Hydrograph; Storm hydrograph; Reservoir planning - Investigations, life of reservoir; Flood estimation and routing, flood forecasting; Surface and sub-surface drainage, water logging, remedial measures, drainage of land; Ground water hydrology - Introduction, types of aquifers, wells, well yield; Soil-Water-Plant relationships, crop water requirement; Layout of canal system; Types and methods of irrigation.

Texts:
1. V.T. Chow, D.R. Maidment, and L.W. Mays, *Applied Hydrology*, McGraw Hill, 1998.
2. V.P. Singh, *Elementary Hydrology*, Prentice Hall, 1993.

References:
1. H.M. Raghunath, *Hydrology – Principles, Analysis and Design*, Wiley Eastern Ltd., 1986.
2. A.M. Michael, *Irrigation – Theory and Practice*, Vikas Publishing House, 1987.
3. D.K. Todd, *Groundwater Hydrology*, John Wiley & Sons, 1993.
4. K. Linsley, *Water Resources Engineering*, McGraw Hill, 1995.

CE 232 ENVIRONMENTAL ENGINEERING LAB (0-0-3-3)

Solid analysis; pH, Alkalinity, Turbidity and Conductivity measurements; Estimation of Hardness, Dissolved Oxygen, BOD and COD; Plate Counts and MPN test; Estimation of Fluoride and metals using colorimetric methods, Introduction to advance instruments i.e. Atomic Adsorption Spectroscopy (AAS).

Texts/References:
1. C. N Sawyer, P. L McCarty and G. F. Parkin, *Chemistry for Environmental Engineers*, McGraw-Hill,1994.
2. APHA, *Standard Methods Examination of Water and Wastewater*, American Public Health Association, Washington DC, 1995.
3. *Manual for Sewer and Sewerage*, Central Public Health & Environmental Engineering Organisation, Ministry of Housing and Urban
Development, Govt. of India, 1993.
1. *Manual for water supply and treatment* , Central Public Health & Environmental Engineering Organisation, Ministry of Housing and Urban Development, Govt. of India, 1999.

CE 234 GEOTECHNICAL ENGINEERING I LAB (0-0-3-3)

Specific gravity test, Sieve analysis, Hydrometer analysis, Atterberg limits, Classification of soil, Compaction test, Permeability test, Relative density, Field density test.

Texts:
1. D. Fratta, J. Aguettant, and L. R. Smith, *Soil mechanics laboratory testing*, Boca Raton, CRC Press, USA, 2007.
2. J. Bardet, *Experimental soil mechanics*, Upper Saddle River, Prentice Hall, USA, 1992.

References:

1. C. Liu and J. B. Evett, *Soil properties: testing, measurement and evaluation*, Upper Saddle River, Prentice Hall, USA, 1997.
2. J. Biarez, and P. Y, Hicher, *Elementary mechanics of soil behaviour: saturated remoulded soils,* Rotterdam A.A., Balkema, USA, 1994.
3. R. Jack, *Understanding soil mechanics*, Albany Delmar Pub., 1995.

CE 301 STRUCTURAL ANALYSIS – II (3-1-0-8)

Classical method of analysis of framed Structures: Slope deflection method, Moments distribution methods, effect of symmetry and antisymmetry, sway correction, Approximate methods: Substitute frame methods for gravity load, Lateral load analysis: Portal and Cantilever methods, Matrix method of structural analysis: Stiffness method: Local and global stiffness matrices, assembly, band storage, solution of resulting simultaneous algebraic

equation, boundary conditions, application to plane and space truss, analysis of plane frame, grid and three dimensional frame.

Texts:
1. W. Weaver and J. M. Gere, *Matrix analysis of framed structures*, CBS Publishers, 2nd edition, 2004.
2. C.K. Wang, *Intermediate Structural Analysis*, Tata McGraw Hill, 1984.

References:
1. C.S. Reddy, *Basic Structural Analysis*, Second Edition, Tata McGraw Hill, 2005.
2. G.S. Pandit and S.P. Gupta, *Structural Analysis - A matrix approach*, Tata McGraw Hill, 2nd edition, 2008.
3. C.H. Norris, J.B. Wilbur, S.Utku, *Elementary Structural Analysis*, Tata McGraw Hill, 4th edition, 2003.
4. M.B. Kanchi, *Matrix Methods of Structural analysis*, Enlarged edition, Wiley Eastern Limited, 1993.

CE 303 ENVIRONMENTAL ENGINEERING II (3-0-0-6)

Particle Fluid Mechanics as applied to the settling of Type I and II suspensions. Design and operation of Sedimentation Tanks. Coagulation and Flocculation. Hydraulics of Filtration, Design and Operation of Filter Units. Disinfection Methods. Ion exchange and Adsorption. Water Softening, Manganese and Iron Removal. Wastewater Treatment – Preliminary, Primary and Secondary Treatment Units. Aerobic and Anaerobic Processes. Purpose, theory and design of aeration units. Sludge treatment and disposal, Wastewater stabilization ponds, Aerated ponds and Oxidation ditches. Site-visits to Water and Wastewater Treatment Works.

Texts:
1. H. S Peavy, D. R Rowe and G. Tchobanoglous, *Environmental Engineering*, McGraw-Hill International Ed.,1985.
2. Metcalf & Eddy*, Wastewater Engineering- Treatment and Reuse* (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata McGraw Hill, 4th Edn., 2004.

References:
1. T. J McGhee, *Water Supply and Sewerage*, McGraw-Hill, Inc,1991.
2. J. M. Montgomery, *Water Treatment Principles and Design*, John Wiley & Sons,1985
3. M. L Davis and D. A Cornwell, *Introduction to Environmental Engineering*, McGraw-Hill, Inc.,1991.
4. S. J Arceivala and S. R. Asolekar, *Wastewater Treatment for Pollution Control and Reuse*, Tata McGraw Hill, 2006.

CE 305 GEOTECHNICAL ENGINEERING – II (3-0-0-6)

Types of retaining walls, Earth pressure theories, Sheet piles and bulkheads; Shallow foundations: Terzaghi's bearing capacity theory, Stress distribution, Immediate and consolidation settlement; Deep foundations: Load carrying capacity of piles, Settlement of pile groups; Foundation types, selection and design; Stability of slopes, Site investigation and subsoil exploration.

Texts:
1. G. Ranjan and A.S.R. Rao, *Basic and Applied Soil Mechanics*, New Age International, 2000.

2. J.E. Bowles, *Foundation Analysis and Design*, McGraw Hill, 1996.

References:
1. S.R. Kaniraj, *Design Aids in Soil Mechanics & Foundation Engineering*, Tata McGraw Hill,1988.
2. P.N. Kurian, *Design of Foundation Systems: Principles & Practices*, Narosa, 1994.

CE 307 FLUID MECHANICS (3-0-0-6)

Fluid properties; Pressure measurement; Hydrostatic forces on plane and curved surfaces; Buoyancy and equilibrium; Stability, metacentric height; Types of flow; Continuity; Energy and momentum equations; Velocity distribution and velocity coefficients, practical applications; Navier Stoke equation; Shear stress and pressure gradient; Flow through pipes, Hagen-Poiseuille equation; Turbulence, Prandtl's mixing length, eddy viscosity; Darcy-Weisbach equation for flow through pipes, friction factor, Moody diagram, minor losses, pipes in series and parallel, equivalent length, pipe network analysis; Water hammer; Boundary layer concept, drag coefficients, control of boundary layer; Dimensional analysis and similitude.

Texts:
1. V.L. Streeter and E.B. Wylie, *Fluid Mechanics*, McGraw Hill, 1997.
2. P.N. Modi and S.M. Seth, *Hydraulics and Fluid Mechanics*, Standard Book House, 1998.

References:
1. B.F. White, *Fluid Mechanics*, McGraw Hill, 1994.
2. K S. Massey,*Mechanics of Fluids*, Van Nostrand Reinhold Co., 1979.
3. J. Frabzini,*Fluid Mechanics with Engineering Applications*, McGraw Hill, 1997.
4. J.H. Spurk, *Fluid Mechanics – Problems and Solutions*, Springer, 2003.

CE 309 REINFORCED CONCRETE DESIGN (3-0-0-6)

Working stress and limit state method of design of R.C. Structures, Design of Beam: Singly reinforced, Doubly reinforced beam, Flanged beam, Shear and bond, development length, detailing of reinforcement, Torsion, Serviceability criteria: Deflection, Design of Slab: One way and two way slab, detailing, redistribution of moments, Design of Column: Axial loading, Uniaxial bending, Biaxial bending, Slender column, Foundation: Isolated and Combined footing.

Texts:
1. S. U. Pillai and D. Menon, *Reinforced Concrete Design*, Tata McGraw-Hill 3rd edition, 2009.
2. P.C. Varghese, *Limit State Design of Reinforced Concrete*, Prentice Hall India, 2008.

References:
1. S.N. Sinha, *Reinforced Concrete Design*, Tata McGraw-Hill, 2nd Edition, 2002.
2. M.L. Gambhir, *Fundamentals of Reinforced Concrete Design*, Prentice Hall India, 2006.
3. A. K. Jain, *Reinforced concrete: Limit state design*, Nem Chand and Bros. 1999.
4. J. Macgregor and J. K. Wight, *Reinforced Concrete: Mechanics and Design*, Prentice Hall, 5th edition, 2008.

CE 331 GEOTECHNICAL ENGINEERING – II LAB (0-0-3-3)

Direct shear test, Vane shear test, Unconfined compression test; Triaxial compression tests: Unconsolidated undrained, Consolidated undrained, Consolidated drained; Consolidation test, Standard penetration test.

Texts:
1. Fratta, D. Aguettant, J. and Roussel- Smith, L., *Soil mechanics laboratory testing*, Boca Raton, CRC Press, USA, 2007.
2. J. Bardet, *Experimental soil mechanics*, Upper Saddle River, Prentice Hall, USA,1992.

References:
1. Liu, C. and Evett, J. B. , Soil properties: testing, measurement and evaluation, Upper Saddle River, Prentice Hall, USA, 1997.
2. Biarez, J. and Hicher, P-Y., *Elementary mechanics of soil behaviour: saturated remoulded soils*, Rotterdam A.A., Balkema, USA, 1994.

3. Jack, R., *Understanding soil mechanics*, Albany Delmar Pub., 1995

CE 333 Fluid Mechanics LAB (0-0-3-3)

List of Experiments
1. Verification of Bernoulli's theorem.
2. Verification of Impulse momentum principle.
3. Study of various types of flows using Reynolds apparatus.
4. Calibration of Venturimeter.
5. Calibration of Nozzle meter.
6. Calibration of Orifice meter.
7. Calibration of Orifice.
8. Calibration of Rota meter
9. Calibration of V-Notch.
10. Calibration of water meter

Texts/References:

1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, 1998.
2. K. L Kumar, Engineering Fluid Mechanics, Eurasia Publishing Company (P) Ltd., New Delhi, 1999.

CE 302 TRANSPORTATION ENGINEERING I (3-0-0-6)

Introduction to Transportation Engineering; Vehicle and driver characteristics; Pavement materials and characterization; Pavement analysis and design: Flexible pavements, Rigid pavements; Geometric design of Highways: Cross sectional elements, Horizontal alignment, Vertical alignment; Evaluation of Transportation Improvement; Terminology used in railways; Track design; Points and crossings; Capacity of Railway transit systems.

Texts:
1. P. Chakroborty and A. Das, *Principles of Transportation Engineering*, Prentice Hall India, 2003.
2. S.C. Saxena and S.P. Arora, *A text book of Railway engineering*, Dhanpat Rai, 2001.

References:
1. C.J. Khisty and B.K. Lall, *Transportation Engineering: an introduction*, Prentice Hall India, 2003.
2. F.L. Mannering, W.P. Kilareski, and S.S. Washburn, *Principles of Highway engineering and traffic analysis,* John Wiley and Sons, 2005.
3. C.S. Papacostas and P.D. Prevedouros, *Transportation Engineering and Planning*, Prentice Hall India, 2001.
4. J.H. Banks, *Introduction to Transportation Engineering*, McGraw-Hill, 2002.

CE 304 CONSTRUCTION TECHNOLOGY & PROJECT MANAGEMENT (3-0-0-6)

Construction as industry and its challenges, Role of construction management, Methods of construction managements, Basic requirements of construction management: Learning structures, Life cycle of construction projects: Examples of real projects and its learning requirements, Stages of awarding contract, types of contract, contract documents, arbitration and settlement of disputes, contract laws and handling of contracts, commissioning of project, Principles of estimation, Principles of general and detailed specifications, Introduction to network based project management techniques: Defining activities and their interdependence, drawing of network, time and resource estimations, use of network as scheduling techniques, use of network as control techniques i.e. project monitoring, Construction Technology: construction of superstructure and substructures, Various construction methods: Excavation, Earth-moving, Drilling, Blasting, Dewatering, foundation, Finishing items, painting, flooring, brick works. Examples of construction of structures such as buildings, bridges, roads, tunnels, industrial structures, Quality Management and Construction safety, Use of information technology in construction industries, Automation in construction industry: a general discussion.

Texts:
1. F. Harris, R. McCaffer and F. Edum-Fotwe, *Modern Construction Management*, Blackwell Publishing, 2006.

2. C. J. Schexnayder and R. E. Mayo, *Construction Management Fundamentals*, McGraw Hill, New Delhi, 2003.

References:
1. J. Singh, *Heavy Constructon-Planning, equipment and methods*, Oxford & IBH Publishing Co. Pvt 1993.
2. R.L. Peurifoy and C.J. Schexnayder, *Construction planning and equipment, and methods*, Sixth edition, Tata McGraw-Hill, 2006.
3. D.S. Berrie and B.c. Paulson, *Professional construction management including C.M., Design construct and general contracting*, Third edition, McGraw Hill International edition, 1992.
4. L.S. Srinath, *PERT and CPM principles and Applications*, Third edition, Affiliated east-west press Pvt Ltd, 2001.
5. D.G. Carmichael, *Construction engineering Networks: Techniques, planning and management*, Ellis Horwood Publishers Chichester 1989.
6. K.K. Chitkara, *Construction project management: planning, scheduling and controlling*, Tata McGraw-Hill, 2008.

CE 306 DESIGN OF STEEL STRUCTURES (3-1-0-8)

Steel structures - advantages, design loads, structural steel sections, material properties, Codes and Specifications: IS 800, 2007, Design Concepts: Working stress design, limit state design, plastic design, LRFD. Classification of sections, Forms of constructions, Design of connections, types of connections, Bolt connections: ordinary black bolts, HSFG bolts and their design in shear, bearing, bending, tension; prying force, slip resistance, block shear failure. Welded connections: different types of weld connections and design, detailing of connections. Design of eccentric connections, Design of tension members: design criteria, net and gross area, examples, Design of compression members: concept of stability and buckling, failure modes, effective lengths, local and global buckling, design of compression members of various types. Design of flexural members: moment curvature relations, stability and lateral-torsional buckling, design against shear, serviceability requirements, beam column design. Design of base plates, load transfer mechanism, design of slab base, gusseted base and anchorage. Steel structural systems.

Texts:
1. N. Subramanian, *Design of Steel Structures*, Oxford University Press, 2008.
2. L. S. Negi, *Design of Steel Structures*, Tata McGraw Hill, 1997.

References:
1. S. A. Raz, *Structural Design in Steel*, New Age International Publisher, 2002.
2. M. Edwin, J. Gaylord and J. E. Stallmeyer, *Design of Steel Structures*, McGraw-Hill, 1991.
3. P. Dayaratnam, *Design of Steel Structures*, S. Chand & Co., 2003.
4. S. M. A. Kazimi and R. S. Jindal, *Design of Steel Structures*, Prentice Hall of India Pvt Ltd, 1988.

CE 308 HYDRAULICS AND HYDRAULICS STRUCTURES (3-0-0-6)

Open channel hydraulics, uniform flow, critical flow, Gradually varied flow, hydraulic jump, unsteady flow; Introduction to pumps and turbines; Channel design, erodable and non erodable channels, silt theories, sediment transport; Introduction to river engineering, meandering, river training works; Introduction to Dam engineering, classification of Dams, design of spillway; Basic principle of design of hydraulic structures; Cross drainage works.

Texts:
1. V.T. Chow, *Open Channel Flow*, McGraw Hill, 1975.
2. S.K. Garg, *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers, 1992.

References:
1. H.M. Chaudhry, *Open Channel Flow*, Prentice Hall of India, 1998.
2. K. Subramanya, *Flow in Open Channels*, Tata McGraw Hill, 1998.
3. V.L. Streeter and E.B. Wylie, *Fluid Mechanics*, McGraw Hill, 1997.
4. B.F. White, *Fluid Mechanics*, McGraw Hill, 1994.

CE 332 TRANSPORTATION ENGINEERING I LAB (0-0-3-3)

Laboratory: Evaluation of road aggregates for various properties: Sieve Analysis, Los Angeles Test, Flakiness and Elongation Test, Impact Test, Angularity Number Test, Evaluation of Bitumen for various properties: Softening Point Test, Penetration Test, Viscosity Test, Ductility Test, Stripping Test, Bituminous mix design – Marshal Mix Design Method.

Texts:
1. S.K. Khanna and C.E.G. Justo, *Highway Engineering*, Nem Chand Bros., 2002.
2. N.A. Harold, *Highway materials, Soil and Concrete*, Prentice Hall, 2004.

References:
1. IS Codes and IRC Codes.

334 Hydraulics and Hydraulic Structures Lab (0-0-3-3)

Determination of resistance coefficient in open channels, Experimental study on variation of specific energy with depth of flow in open channels, Measurement of flow using weirs and notches, Measurement of flow using a Parshall flume, Experiments on gradually varied flow (GVF) in open channels, Experimental study on hydraulic jumps, Experimental studies on centrifugal and reciprocating pumps, Experimental studies on impulse and reaction turbines.

Texts/References:
1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, 1998.
2. K. L Kumar, Engineering Fluid Mechanics, Eurasia Publishing Company (P) Ltd., New Delhi, 1999.

CE 401 TRANSPORTATION ENGINEERING –II (3-0-0-6)

Traffic flow fundamentals; Uninterrupted Traffic flow: Traffic stream characteristics, Traffic flow models, capacity and LOS analysis; Interrupted Traffic flow: Traffic flow at signalized and un signalized intersections; Design of Traffic facilities: Highways, intersection, interchanges; Transportation planning; Introduction to planning; Travel demand forecasting: Four step planning, Advance methods for travel demand forecasting; Airport related Terminology; Airport configuration; Geometric design of runway; Air travel demand forecasting; Harbor related Terminology; Traffic forecasting and hinterland; Harbor layout.

Texts:
1. C.S. Papacostas and P.D. Prevedouros, *Transportation Engineering and Planning*, Prentice Hall India, 2001.
2. R. Horonjeff and F.X. McKelvey, *Planning and design of airports,* McGraw-Hill, 1994.

References:
1. P. Chakroborty and A. Das, *Principles of Transportation Engineering*, Prentice Hall India, 2003
2. R.P. Roess, W.R. McShane, and E.S. Prassas, *Traffic Engineering*, Prentice Hall, 1990.
3. H.P. Oza and G.H. Oza, *Dock and Harbor Engineering*, Chorotar, 4th edition, 1999.

CE 431 COMPUTATIONAL LABORATORY (0-0-3-3)

Load calculations & design of structures using computational programmes/softwares, Application of Civil Engineering softwares- StadPro, Kaline-4, Ansys, Sap-2000.

Text:
1. V. K. Raina, *Concrete bridge Practice: Analysis, Design and Economics*, Tata McGraw-Hill, 2002.

References:
1. S. U. Pillai and D. Menon, *Reinforced Concrete Design*, Tata McGraw-Hill 3rd Edition, 2009.
2. Bureau of Indian Standards, *IS 456: 2000 – Plain and Reinforced Concrete – Code of Practice*, 2000.
3. Bureau of Indian Standards, *SP 34: 1987 – Handbook of Concrete reinforcement and Detailing*, 1987.
4. Bureau of Indian Standards, *SP 16: 1980 – Design Aids for Reinforced Concrete*, 1980.