# Syllabi of

# Fifth Semester B.Tech Degree Programme in

# CIVIL ENGINEERING

# CE 3001 STRUCTURAL ANALYSIS - II

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Prerequisite: CE2005 Structural Analysis - I**

**Total hours: 42**

**Module 1 and 2 (20 hours)**

**Statically indeterminate structures:** Degree of static and kinematic indeterminacies - brief introduction to force and displacement methods
**Force method of analysis of indeterminate structures**
Fixed and continuous beams - analysis by consistent deformation method - application of moment area and conjugate beam methods for fixed beams - theorem of three moments for continuous beams - shear force and bending moment diagrams - deflection and support settlement
Analysis of rigid frames of different geometry by consistent deformation method – settlement effects - analysis of pin-jointed trusses by consistent deformation method - externally and internally redundant trusses - effects of support settlement and pre-strains.

**Module 3 (12 hours)**

**Displacement method of analysis of indeterminate structures**
Slope deflection method - analysis of continuous beams - beams with overhang - analysis of rigid frames - frames with sloping legs - gabled frames - frames without sway and with sway -settlement effects - moment distribution method as successive approximation of slope deflection equations - analysis of beams and frames - non-sway and sway analyses

**Module 4 (10 hours)**

**Plastic Analysis**
Plastic theory - introduction - plastic hinge concept - plastic modulus - shape factor -redistribution of moments - collapse mechanism - plastic analysis of beams and portal frames by equilibrium and mechanism methods.

**References**

1. Menon, D., Structural Analysis, Narosa publishers, 2008.
2. Wang, C. K., Intermediate Structural Analysis, McGraw Hill, 1989.
3. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, 2007.
4. Negi, L. S., and Jangid R.S, Structural Analysis, Tata McGraw Hill, 2006
5. Wilbur, J. B., Norris, C. H., and Utku, S., Elementary Structural Analysis, McGraw Hill, 2006.
6. Timoshenko, S. P. ,and Young ,D. H., Theory of Structures, McGraw Hill, 1988.
7. Hibbler, R. C., Structural Analysis, Pearson Education, 2006.

# CE 3002 STRUCTURAL DESIGN - I

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 3 |

**Prerequisite: Nil**

**Total hours: 42**

**Module 1 (12 hours)**

*Introduction* –Structures and structural systems–Internal forces in different types of structural systems such as Trusses, Cables, Arches, Beams and Slabs, Frames – stability criteria – design considerations – Different loadings, loading standards
Design philosophy: Working Stress Method, Ultimate load method, probabilistic analysis and Limit State method - Limit state of collapse, Limit state of serviceability.

*Limit state of collapse: Flexure*
Assumptions – moment capacity of rectangular and flanged sections - singly and doubly reinforced sections - design tables and charts – critical sections for bending in important structural elements such as slabs, beams, retaining wall, footings, staircase etc.

*Limit state of Serviceability*: Deflection –short term and long term deflection- cracking.

**Module 2 (10 hours)**

*Limit State of Collapse: Shear*
Nominal shear stress- design shear strength of concrete – design of shear reinforcement – critical sections for shear in important structural elements such as beams, retaining walls, footings etc.
Design of slabs, beams, retaining walls, footings and stair case.

*Limit State of Collapse: Torsion*
General – critical section – equivalent shear and bending moment– reinforcement for torsion.

**Module 3 (10 hours)**

*Limit State of Collapse: Compression*
Analysis and design of columns of rectangular and circular cross sections - axially loaded columns - columns with uniaxial and biaxial eccentricity using SP 16 design charts - short and slender columns.

**Module 4 (10 hours)**

*Introduction to EQ design and detailing*: Concept of Seismic design - Approach to earthquake resistant design – General principles of a seismic design – Review of IS 1893:2002, Guide lines for earthquake resistant design – Ductile detailing for seismic design

*Introduction to Pre-stressed concrete*: High strength concrete and high tensile steel – tensioning devices – pretensioning systems – post tensioning systems - Analysis of prestress – losses of prestress.

**References**

1. Pillai, S. U., and Menon, D., Reinforced Concrete Design Tata McGraw Hill, 2003.
2. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall of India, 2003.
3. Mallick, S. K., and Gupta, A. K., Reinforced Concrete, Oxford and IBH, 1982.
4. Jain, A. K., Reinforced Concrete - Limit State Design, Standard Book House, 1998.
5. Punmia, B. C., Reinforced Concrete Structures Vol. I, Standard Book House , 2005
6. Jain and Jaikrishna, Plain and Reinforced Concrete Vol. I, Nemchand, 2000.

7.  Sinha, S. N., Reinforced Concrete Design, Tata McGraw Hill, 2005.
8.  BIS Codes ( IS 875, IS 456, IS 2750, IS 1893, IS 4326, IS 13920, IS 1343).
9.  Krishna Raju, N., Prestressed concrete, Tata McGraw Hill, 2000
10. Dayaratnam, P., Prestressed Concrete, Oxford and IBH,1982

# CE3003 WATER RESOURCES ENGINEERING - I

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisite: CE2006 Open channel Hydraulics and Hydrology**

**Total hours: 42**

**Module 1 (10 hours)**

**Introduction**
Water resources projects – Introduction- Water resources of India- Range of water resources projects - General planning philosophy- Water allocation priorities - Water Supply – Irrigation - Flood control- Hydropower. Data requirement and data collection for different projects - Water availability studies. Environmental checklist for Water Resources projects.
Irrigation - Development of Irrigation in India- Major-Medium and minor irrigation schemes– Command area development and participatory irrigation management. Planning of Irrigation projects. Traditional systems of irrigation and water harvesting in India.

**Module 2 (10 hours)**

**Irrigation Engineering**
 Soil water system – Soil classification - Soil water constants - Consumptive use - Crops- crop seasons, cropping patterns and crop water requirements. Irrigation water requirement. Methods of irrigation and Irrigation efficiency.
Classification of irrigation projects -Direct and storage irrigation - Irrigation project components. Diversion structures for direct irrigation - Weirs and Barrages – Site selection -Components of diversion head work. Design of weirs / barrages – Hydraulic design for water way and sub surface flow - Bligh's and Khosla's theories. Structural design of different elements. Training and protection works.

**Module 3 (8 hours)**

**Distribution system**-
Distribution canals - classification, alignment and components of canals. Canal regulation.Transport of sediment in canals. Design of rigid boundary canals. Design of alluvial channels. Regime channels- Kennedy's and Lacey's methods. Water logging and drainage of irrigated lands.

**Module 4 (14 hours)**

**Canal structures-**
Canal regulation structures- canal falls-different types of canal falls and selection of type-Structural elements of a fall - Design of vertical, notch type and siphon drops. Canal headwork Head and cross regulators- Design criteria – sediment control at head regulator- Design of a regulator. Canal escapes- Weir and sluice escapes. Outlets- modular and non-modular outlets. Cross Drainage structures-Need - Types- Design considerations – design of a type III aqueduct.

**References**

1. Varshney, R. S., Gupta, S. C., and Gupta, R. L., Theory and Design of Irrigation Structures, Vol. II, Nem Chand Publication, 1993.
2. Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 2004.
3. Modi, P. N., Irrigation Water resources and Water power engineering, Standard book house, 2008.
4. Asawa, G L, Irrigation Engineering, New Age Publications, 2005.
5. FAO Irrigation, Water resources and Drainage Papers, 26/1,26/2 Small Hydraulic Structures, Vol 1 and 2, 1982.
6. FAO Irrigation water management Training Manuals 1(1985), 3(1986), 4(1988), and 5(1989)
7. All relevant BIS codes.

# CE3004 GEOTECHNOLOGY

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisite: CE2009 Geosciences**

**Total hours: 42**

**Module 1 (10 hours)**

**Shear Strength:** Definition - Mohr's strength and stress circles - origin of planes - Mohr's envelope - Mohr-Coulomb strength theory -Direct, triaxial and UCC tests - Drainage conditions - Measurement of pore pressure - Vane shear tests -Total and effective stress -strength parameters – Stress path, Liquefaction of sand - Choice of test conditions for field problems.
**Stability of slopes:** Slope failure, base failure and toe failure - Swedish circle method - φ=0 analysis and c=0 analysis - Friction circle method - Taylor's stability number -Stability charts - Sliding block analysis.

**Module 2 (9 hours)**

**Earth pressure**: Earth pressure at rest - Active and passive earth pressure for cohesionless and cohesive soils - Coulomb's and Rankine's theories - Point of application of earth pressure for cases of with and without surcharge in cohesionless and cohesive soils - Culmann's and Rebhan's graphical construction for active earth pressure- Friction circle method for passive earth pressure.
**Site investigation and soil exploration**: Objectives - Planning -Reconnaissance – Depth of exploration - Methods of subsurface exploration - test pits -auger borings – wash boring - rotary drilling – percussion drilling – core drilling –Sampling - Types of soil samples- Split spoon sampler - Thin walled sampler – Piston sampler-Denison sampler - hand cut samples - Location of water table - S.P.T. - Field vane shear test -    Geophysical methods (in brief) - Boring log - Soil profile.

**Module 3 (12 hours)**

**Bearing capacity**: Ultimate and allowable bearing capacity - Terzaghi's equation for bearing capacity for continuous circular and square footings –Types of shear failures – Bearing capacity factors and charts - Effect of water table on bearing capacity – Meyerhoff's bearing capacity theory - Skempton's formulae – Bearing capacity from field tests - Bearing capacity from building codes - Net bearing pressure - Methods of improvement of soil bearing capacity: vibro flotation and sand drains.
**Settlement analysis**: Distribution of contact pressure - Immediate and consolidation settlement - Estimation of initial and final settlement under building loads - Limitations in settlement computation - Causes of settlement - Permissible, total and differential settlements - Cracks and effects of settlement.
**Foundation - general consideration**:Functions of foundations - Requisites of satisfactory foundations - Different types of foundations - Definition of shallow and deep foundation - Selection of type of foundation - Advantages and limitations of various types of foundations - Design considerations - Footings subjected to eccentric loading - conventional procedure for proportioning footings for equal settlements.

**Module 4 (11 hours)**

**Open excavation:** Open foundation excavations with unsupported slopes - Supports for shallow and deep excavations - Stress distribution in sheeting and bracing of shallow and deep excavations - Stability of bottom of excavations.
**Raft foundations**: Bearing capacity equations - Design considerations – Conventional design procedure for rigid mat - Uplift pressures - Methods of resisting uplift - Floating foundations.
**Pile foundations**: Uses of piles - Classification of piles based on purpose and material - Determination of type and length of piles -Determination of bearing capacity of axially loaded single vertical pile - (static and dynamic formulae) - Determination of bearing capacity by penetration tests and pile load tests (IS methods) - Negative skin friction - Group action and pile spacing - Analysis of pile groups - Load distribution by Culmann's method.

**Note:** Structural designs of foundations are not contemplated in this course. Self study on Caissons and piers should be encouraged to the students.

**References**

1.  Joseph, E., and Bowles, Foundation Analysis and Design, McGraw-Hill, 1996
2.  Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2005.
3.  Leonards, G. A., Foundation Engineering, McGraw Hill, 1962.
4.  Teng, W. C., Foundation Design, PHI, 1984
5.  Tomlinson, M. J., Foundation Design and Construction, Pitman, 2001.
6.  Terzaghi and Peck, Soil Mechanics in Engineering Practice, Asia Publishing, 1996
7.  Arora, K. R., Soil Mechanics and Foundation Engineering, Standard Publications, 2009.
8.  Murthy, V. N. S., Soil Mechanics and Foundations, 2009.
9.  Iqubal, H. Khan, Geo-technical Engineering, 1999
10. Punmia, B. C., Soil Mechanics and Foundations, Laxmi, 2005.

# CE3005 TRANSPORTATION ENGINEERING - I

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| 3 | 0 | 0 | 3 |

**Prerequisite: Nil**

**Total hours: 42**

**Module 1 (11 hours)**

**Highway Classification, Alignment and Geometrical Design:** Introduction - Highway development in India - Classification of roads - Typical cross sections of roads in urban and rural area - Requirements and factors controlling alignment of roads -Engineering surveys for highway location - Pavement surface characteristics - Camber and width requirements - Sight distances - stopping and overtaking sight distances, overtaking zone requirements - Design of horizontal alignment -speed, radius, super elevation, methods of providing super elevation, extra widening of pavements, transition curves - Design of vertical alignment - gradient, grade compensation, summit curves and valley curves - worked out problems on all the above topics.

**Module 2 (9 hours)**

**Traffic engineering:** Introduction - Road user, vehicle and traffic characteristics - Speed and volume studies - Simple worked out problems - Principles of design of at-grade intersections - Simple layouts - Objectives, classification and uses of traffic signs and markings - Design of isolated signals by Webster's method.

**Module 3 (12 hours)**

**Pavement Materials and Design:** Desirable properties and testing of highway materials: road aggregates, bituminous materials and subgrade soil – Superpave - Factors influencing the design of pavements - CBR method and IRC guidelines of flexible pavements design - Design of rigid pavements using IRC charts – BBD method of Flexible Overlay Design - worked out problems– Introduction to Mechanistic Empirical Pavement Design.

**Module 4 (10 hours)**

**Pavement Construction and Maintenance:** Historical development of road construction - Construction of earth roads, WBM roads, stabilized roads, bituminous pavements, cement concrete roads and joints in cement concrete roads - Types and causes of failures in flexible & rigid pavements – Remedial Measures – Recycling of pavements.

**References**

1.  Khanna, S. K., and Justo, C. E. G., Highway Engineering, Nemchand and Bros, 2001, Roorkee.
2.  Kadiyali, L. R., and Lal, N. B., Principles and Practices of Highway Engineering, Khanna Publishers, 2008.
3.  O' Flaherty, C. A., Highway-Traffic Planning and Engineering, Edward Arnold., 1986
4.  Yoder and Witczak, Principles of Pavement Design, John Wiley and Sons, 1975
5.  IRC: 37-2001, Guidelines for the Design of Flexible Pavements, IRC 2001
6.  IRC: 58-2002, Guidelines for the Design of Rigid Pavements, IRC 2002
7.  IRC:15-2002, Standard Specifications and Code of Practice for Construction of Concrete Roads
8.  Ministry of Road Transport and Highways Specifications for Roads and Bridges, 2004
9.  David Croney, The Design and Performance of Road Pavements, McGraw Hill, 1997
10. Paul H. Wright and Karen Dixon, Highway Engineering, Wiley, 2003

# CE3006 ENVIRONMENTAL STUDIES IN CIVIL ENGINEERING

**Prerequisite: Nil**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 3 |

**Total hours: 56**

**Module 1 (16 hours)**

Multidisciplinary nature of environmental studies. Renewable and non-renewable resources and problems associated with overexploitation – forests, water, minerals, food, energy, land.  Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.
Concept of an ecosystem, Structure and functions of an ecosystem, Producers, consumers and decomposers, Energy flow, Ecological succession, Food chains, food webs and ecological pyramids, Types, characteristic features, structure and functions of the following ecosystems – forests, grasslands, deserts, and aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
Biodiversity – Definition, Genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity,  India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity -  insitu and exsitu conservation of biodiversity.

**Module 2 (16 hours)**

Environmental pollution – Definition, causes, effects and control measures (general) for water, soil, marine, noise, and thermal pollution. Nuclear hazards. Air pollution and control – sources, pollutants and their health effects, particulate and gaseous pollution control devices (fundamentals), settling chambers, electrostatic precipitators, cyclones, wet collectors, gas absorption by tray and packed towers. Solid waste management – Generation, on site handling and storage, transfer and transport, processing, resource recovery, treatment and disposal. Role of an individual in prevention of pollution. Case studies. Social Issues and the Environment - from unsustainable to sustainable development. Environmental ethics - Issues and possible solutions.
Legislation in India - Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act,  Other acts, Issues involved in enforcement of environmental legislation, Public awareness.
Human population and the environment - Population growth, Family welfare programme, Environment and human health, Human rights, HIV/AIDS, Women and child welfare, Role of Information Technology in environment and human health.

**Module 3 (9 hours)**

Scope of Environmental Engineering. Material balance, flow models and reactors, energy balance. Quality of water – water quality parameters - drinking water standards - effects on human health- physical, chemical and bacteriological analysis of water.

**Module 4 (11 hours)**

Water supply schemes – gravitational, pumping and combined schemes. Pumps and Pumping stations. Transmission of water – materials of water supply pipes, distribution systems, different layouts of pipe networks, house connection from mains,  valves, meters and hydrants, storage and  balancing reservoirs, detection and prevention of leaks in distribution systems and maintenance.

**Field work (equivalent to 4 lecture hours)**

Students crediting this course are required to visit a local area and document environmental assets (river, forest, grassland, hill, mountain etc.); or visit a local polluted site (Urban, Rural, Industrial, Agricultural etc.) and make a preliminary assessment the socio-environmental impact; or study common plants, insects, birds; or study simple ecosystems (pond, river, hill slopes, etc.).

Note : *This course covers all topics for the Environmental Studies course stipulated by Honourable Supreme Court of India. Topics relevant for Civil Engg. profession are additionally included.*

**References**

1. Bharucha, E., Textbook of Environmental Studies, University Press, New Delhi, 2005.
2. Nambiar, K. R., Textbook of Environmental Studies, Sci Tech Publications India (P) Ltd., 2009
3. Modi, P. N., Water Supply Engineering, Standard Book House, New Delhi, 2010.
4. Birdie, G. S., and Birdie, J. S., Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, New Delhi, 2007.
5. Garg, S. K., Environmental Engineering, Vol. I, Khanna Publications, New Delhi, 2008.
6. Duggal, K. N., Elements of Environmental Engineering, S Chand and Co. Ltd., New Delhi, 2008.
7. Sawyer and McCarty, Chemistry for Environmental Engg., Tata McGraw-Hill, New Delhi, 2003.
8. Relevant BIS Codes.

# CE3091 BUILDING DESIGN AND DRAWING

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Prerequisite: CE2007 Functional Design of Buildings**

**Total hours: 42**

1. Planning, designing from given requirements of areas & specifications and preparation of sketch design and working drawings for:
2. Residential building- flat and pitched roof, economic domestic units, cottages, bungalows and building flats.
3. Public building – small public utility shelters, dispensaries, banks, schools, offices, libraries, hostels, restaurants, commercial complexes, factories etc.
4. Preparation of site plans and service plans as per Building Rules
5. Septic Tank and Soak Pit – detailed drawings.
6. Plumbing, water supply and drainage for buildings.

**References**

1. SP 7:2005,National Building Code of India
2. Local Building Bye-laws
3. Callender, John Hancock, Time Saver Standards for Architectural Design Data, McGraw Hill, 2000.
4. Chiara, Callender, John Hancock, Time Saver Standards for Building Type, McGraw Hill, 2001.
5. Chiara, Joseph De, Time Saver Standards for Site Planning, McGraw Hill, 1999.
6. Ching, Francis D K, Architectural Graphics. .John Wiley, 2009.
7. Ching, Frank, Architecture – Form, Space and Order.John Wiley, 2007.
8. Ramsey Sleeper, Architectural Graphic Standards, John Wiley, 2001.
9. Scott Robert Gillan, Design Fundamentals, Mc-Graw Hill, 1951.
10. Tessie Agan M.S., The House, Its Plan & Use, Oxford and IBH Publishing Co., 2000.
11. IS 5533 : 1969, Recommendation for Dimensions of Spaces for Human Activities. B.I.S
12. IS 4963 : 1987, Recommendation for Buildings and facilities for the Physically Handicapped. B.I.S
13. Shaw and Kale, Building Drawing, Tata Mc Graw Hill Publishers, 2000.
14. Balagopal T S Prabhu, Building Drawing and Detailing, Spades Publishers, 2007.

# CE3092 GEOTECHNICAL ENGINEERING LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Prerequisite: CE2009 Geosciences**

**Total hours: 42**

**List of experiments:**

1. Specific gravity of coarse and fine grained soils
2. Grain size analysis (a) Sieve analysis (b) Pipette analysis
3. Atterberg's limits and indices
4. Determination of field density (a) sand replacement method, (b) Core cutter method
5. Determination of coefficient of permeability by (a) Constant head method, (b) Variable head method
6. Consolidation test
7. Compaction test (a) IS light compaction test, (b) IS heavy compaction test
8. California Bearing Ratio test
9. Direct shear test
10. Triaxial shear test
11. Unconfined compressive strength test
12. Laboratory vane shear test

# CE3001 STRUCTURAL ANALYSIS - II

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisite: CE2005 Structural Analysis - I**

Statically indeterminate structures, Force method and displacement method of analysis of indeterminate structures - fixed and continuous beams - rigid frames of different geometry - shear force and bending moment diagrams - deflection and support settlement, Plastic Analysis - plastic hinge - plastic modulus - shape factor -redistribution of moments - collapse mechanism - plastic analysis of beams and portal frames

**Total hours: 42**

# CE3002 STRUCTURAL DESIGN - I

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 3 |

**Prerequisite: Nil**

Structures and structural systems – design considerations – loading standards – Design philosophy, Limit state of collapse – Flexure – moment capacity of rectangular and flanged sections - singly and doubly reinforced sections, Shear - design shear strength of concrete – design of shear reinforcement, Torsion – equivalent shear and bending moment – design for torsion, compression - axially loaded columns - columns with uniaxial and biaxial eccentricity - short and slender columns, Limit state of Serviceability - deflection –short term and long term deflection- cracking, Introduction to EQ design and detailing - general principles of a seismic design – review of IS 1893:2002 - guide lines for earthquake resistant design – Ductile detailing for seismic design, Introduction to Pre-stressed concrete - analysis of prestress.

**Total hours : 42**

# CE3003 WATER RESOURCES ENGINEERING – I

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisite: CE2006 Open channel Hydraulics and Hydrology**

Water resources projects - planning philosophy and types, Irrigation engineering-Traditional systems of Irrigation and water conservation-Irrigation requirement –classification of Irrigation projects, Irrigation structures-Canal head structures-Canal regulatory structures-Cross drainage structures-and Outlets

**Total hours: 42**

# CE3004 GEOTECHNOLOGY

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisite: CE2009 Geosciences**

Shear Strength of soil – Different types of shear tests - Shear strength parameters - Stability of slopes **–** Stability analysis - Stability charts, Active and passive earth pressure for cohesionless and cohesive soils - Coulomb's and Rankine's theories, Site investigation and soil exploration - Field tests- boring log - soil profile, Different types of foundations - Bearing capacity -  Terzaghi's equation for bearing capacity - Settlement analysis - Stress distribution in sheeting and bracing of shallow and deep excavations -Raft foundations - Determination of bearing capacity pile - Analysis of pile groups – Caissons.

**Total hours: 42**

# CE3005 TRANSPORTATION ENGINEERING - I

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisite: Nil**

Highway Development – Classification – Cross sections – Alignment – Surveys – Pavement Surface Characteristics – Geometrics – Design of Horizontal & Vertical Alignments – Components of Traffic – Traffic Studies – Design of at-grade Intersections – Desirable Properties & Testing of Highway Materials – Design of Flexible, Rigid Pavements, Overlay – Pavement Construction – Types & Causes of Failures in Flexible & Rigid Pavements – Remedial Measures

**Total hours: 42**

# CE3006 ENVIRONMENTAL STUDIES IN CIVIL ENGINEERING

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 3 |

**Prerequisite: Nil**

Multidisciplinary nature of environmental studies - Renewable and non-renewable resources and problems associated with overexploitation - Equitable use of resources for sustainable lifestyles - Concept of an ecosystem - Structure and functions of an ecosystem – Biodiversity – Definitions - Biogeographical classification of India - Value of biodiversity - India as a mega-diversity nation - Threats to biodiversity - Endangered and endemic species of India - Conservation of biodiversity -  Environmental pollution – Definition, causes, effects and control measures - water, soil, marine, noise, and thermal pollution - Nuclear hazards - Air pollution and control - Solid waste management - Role of an individual in prevention of pollution - Case studies - Social Issues and the Environment - from unsustainable to sustainable development - Environmental ethics - Issues and possible solutions - Legislation in India - Public awareness - Human population and the environment - Population growth - Family welfare programme - Environment and human health -  Human rights - HIV/AIDS, Women and child welfare - Role of Information Technology in environment and human health - Scope of Environmental Engineering - Material balance - Flow models and reactors - Energy balance - Quality of water – water quality parameters - Drinking water standards - Water supply schemes - Transmission of water - Field work.

**Total hours: 56**

# CE3091 BUILDING DESIGN AND DRAWING

**Prerequisite: CE2007 Functional Design of Buildings**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

Planning, designing from given requirements of areas & specifications and preparation of sketch design and working drawings for Residential building- flat and pitched roof-economic domestic units-cottages-bungalows-building flats, Public building – small public utility shelters-dispensaries-banks-schools-offices-libraries-hostels-restaurants-commercial complexes-factories, Preparation of site plans and service plans as per Building Rules, Septic Tank and Soak Pit, Plumbing, water supply and drainage for buildings.

**Total hours: 42**

# CE3092 GEOTECHNICAL ENGINEERING LABORATORY

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

**Prerequisite: CE2009 Geosciences**

Specific gravity of coarse and fine grained soils, Grain size analysis, Atterberg's limits and indices, Determination of field density, Determination of coefficient of permeability, Consolidation test, Compaction test, California Bearing Ratio test, Direct shear test, Triaxial shear test, Unconfined compressive strength test, Laboratory vane shear test

**Total hours: 42**