

# Curriculum and Syllabus for B.Tech Degree Program in Civil Engineering



March 2017  
Department of Civil Engineering  
National Institute of Technology Puducherry  
Karaikal – 609 609

## B.Tech Degree Program in Civil Engineering

<b>FRESHMAN YEAR</b>						
<b>SEMESTER-I</b>						
<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
CE 101	Engineering Mechanics	3	0	0	3	
CE102	Basic Energy, Environment and Agricultural Engineering	2	0	0	2	
<b>SOPHOMORE YEAR</b>						
<b>Semester-III</b>						
<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Type</b>
MA201	Numerical Techniques	3	0	0	3	
CE201	Mechanics of Solids	2	1	0	3	DC-1
CE203	Mechanics of Fluids	2	1	0	3	DC-2
CE205	Surveying	3	0	0	3	DC-3
CE207	Geotechnical Engineering	3	0	0	3	DC-4
CE209	Building Planning and Drawing	0	0	3	2	DC-5
CE211	Material Testing Lab	0	0	3	2	DC-6
CE213	Survey Lab	0	0	3	2	DC-7
	Total	13	02	09	<b>21</b>	
<b>Semester-IV</b>						
<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Type</b>
MA202	Probability Theory and Linear Programming	3	0	0	3	
CE202	Strength of Materials	3	0	0	3	DC-8
CE204	Fluid Flow and Hydraulic Machinery	3	0	0	3	DC-9
CE206	Foundation Engineering	3	0	0	3	DC-10
CE208	Building Materials and Construction	3	0	0	3	DC-11
CE210	Geotechnical Engineering lab	0	0	3	2	DC-12
CE212	Fluid Mechanics lab	0	0	3	2	DC-13
	Total	15	00	06	<b>19</b>	
<b>JUNIOR YEAR</b>						
<b>Semester-V</b>						
<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Type</b>
CE301	Analysis of Indeterminate Structures	3	0	0	3	DC-14
CE303	Basic Design of Concrete Structures	3	0	0	3	DC-15
CE305	Basic Design of Steel Structures	3	0	0	3	DC-16
CE307	Transportation Engineering	3	0	0	3	DC-17
CE309	Water Supply Engineering	3	0	0	3	DC-18
CE311	Water Resources Engineering	3	0	0	3	DC-19
CE313	Concrete Technology Lab	0	0	3	2	DC-20
CE315	Water Testing Lab	0	0	3	2	DC-21
	Total	18	0	06	<b>22</b>	
<b>Semester-VI</b>						
<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Type</b>
CE302	Advanced Design of Concrete Structures	3	0	2	4	DC-22
	Global Elective-I	3	0	0	3	GE-1
	Department Elective-1	3	0	0	3	DE-1

	Department Elective-2	3	0	0	3	DE-2
	Department Elective-3	3	0	0	3	DE-3
HM302	Professional Ethics and Human Values	2	0	0	2	
CE304	Computer Aided Design Lab	0	0	3	2	DC-23
CE306	Transportation Engineering lab	0	0	3	2	DC-24
	Total	17	0	08	<u>22</u>	
<b>Summer Term</b>						
CE308	Industrial Training	0	0	90	<u>1</u>	TP
<b>SENIOR YEAR</b>						
<b>Semester-VII</b>						
<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Type</b>
	Global Elective-II	3	0	0	3	GE-2
	Global Elective-III	3	0	0	3	GE-3
	Department Elective-4	3	0	0	3	DE-4
	Department Elective-5	3	0	0	3	DE-5
	Department Elective-6	3	0	0	3	DE-6
HM401	Industrial Economics and Management	3	0	0	3	
CE491	Project Work Phase I	0	0	9	2	
	Total	18	0	09	<u>20</u>	
<b>Semester-VIII</b>						
<b>CODE</b>	<b>COURSE OF STUDY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Type</b>
	Department Elective-7	3	0	0	3	DE-7
	Department Elective-8	3	0	0	3	DE-8
	Department Elective-9	3	0	0	3	DE-9
	Department Elective-10	3	0	0	3	DE-10
CE492	Project Work Phase II	0	0	18	4	
	Total	12	0	18	<u>16</u>	

**Total Credits (SemIII-21+SemIV-19+SemV-22+SemVI-22+Summer Term-1+SemVII-20+SemVIII-16) = 121**

<b>List of Electives</b>						
<b>Electives Offered in VI<sup>th</sup> Semester</b>						
CE502	Advanced Methods of Structural Analysis	3	0	0	3	
CE504	Bridge Engineering	3	0	0	3	
CE506	Advanced Surveying	3	0	0	3	
CE508	Ground Improvement Techniques	3	0	0	3	
CE510	Earth and Earth Retaining Structures	3	0	0	3	
CE512	Environmental Engineering	3	0	0	3	
CE514	Solid and Hazardous Waste Management	3	0	0	3	
CE516	Industrial Waste Management	3	0	0	3	
CE518	Railway, Airport and Harbour Engineering	3	0	0	3	
CE520	Traffic Engineering	3	0	0	3	
CE522	Pavement Engineering	3	0	0	3	
CE524	Irrigation and Hydraulic Structures	3	0	0	3	
CE526	Hydrology	3	0	0	3	
CE528	Irrigation Management	3	0	0	3	
CE530	Lab Oriented Mini Project	0	0	6	3	
CE532	Estimation, Costing and Valuation	3	0	0	3	

<b>Electives Offered in VII<sup>th</sup> Semester</b>					
CE501	Advanced Design of Steel Structures	3	0	0	3
CE503	Introduction to Structural Dynamics, Seismology and Earthquake Resistant Structures	3	0	0	3
CE505	Advanced Composite Structures	3	0	0	3
CE507	Reinforced Earth and Geotextiles	3	0	0	3
CE509	Earthquake Geotechnical Engineering	3	0	0	3
CE511	Advanced Foundation Engineering	3	0	0	3
CE513	Environmental Impact Analysis	3	0	0	3
CE515	Environmental Pollution Control Engineering	3	0	0	3
CE517	Environmental Risk Assessment	3	0	0	3
CE519	Railway Engineering	3	0	0	3
CE521	Transportation Planning	3	0	0	3
CE523	Transportation Infrastructure Design	3	0	0	3
CE525	Water Resources Systems	3	0	0	3
CE527	Hydro Power	3	0	0	3
CE529	Coastal Engineering	3	0	0	3
CE531	Computer Oriented Mini Project	0	0	6	3
CE533	Housing Planning and Management	3	0	0	3
CE535	Modern Construction Materials	3	0	0	3
<b>Electives Offered in VIII<sup>th</sup> Semester</b>					
CE534	Finite Element Analysis	3	0	0	3
CE536	Prestressed Concrete Structures	3	0	0	3
CE538	Fundamentals of Nanoscience	3	0	0	3
CE540	Ecological Engineering	3	0	0	3
CE542	Remote Sensing and GIS	3	0	0	3
CE544	Concrete Technology	3	0	0	3
CE546	Contract laws and Regulations	3	0	0	3
CE548	Ground Water Hydrology	3	0	0	3
CE550	Construction Management	3	0	0	3
<b>Global Electives Offered by Civil Engineering</b>					
CE1001	Architectural Heritage of India	3	0	0	3
CE1002	Global Warming and Climate Change	3	0	0	3
CE1003	Basic Mechanics of Solids, Fluids and Fluid Machinery	3	0	0	3

# **FRESHMAN YEAR**

## **CE101-ENGINEERING MECHANICS**

**Unit-I:** Fundamentals: Mechanics and its relevance, concepts of forces, laws of mechanics parallelogram law, Lami's theorem, Law of polygon, concept of free-body diagram, centroids, center of gravity, area moment of inertia, mass moment of inertia – simple and composite planes, simple truss analysis, Numerical problems.

**Unit-II:** Friction: Laws of friction, static friction, rolling friction, application of laws of friction, ladder friction, wedge friction, body on inclined planes, simple screw jack – velocity ratio, mechanical advantage, efficiency, Numerical problems.

**Unit-III:** Statics: Principles of statics, types of forces, concurrent and non-concurrent forces, composition of forces, forces in a plane and space, simple stresses and strains, elastic coefficients, Numerical problems.

**Unit-IV:** Kinematics: Fundamentals of rectilinear and curvilinear motion, application of general equations, concept of relative velocity, analytical and graphical techniques, Numerical problems.

**Unit-V:** Dynamics: Principles of dynamics, D'Alembert's principle, conservation of momentum and energy, vibrations of simple systems, Numerical problems.

### **Text Books**

1. S. Timoshenko and D. H. Young, Engineering Mechanics, McGraw Hill, 2006.
2. K. L. Kumar and V. Kumar, Engineering Mechanics, Tata McGraw Hill, 2011.
3. M. S. Palanichamy and S. Nagan, Engineering Mechanics – Statics & Dynamics, Tata McGraw Hill, 2002.
4. E. P. Popov, Engineering Mechanics of Solids, Prentice Hall, 1998.

### **Reference Books**

1. I. H. Shames and G. K. M. Rao, Engineering Mechanics – Static and Dynamics, Pearson Education, 2009.
2. F. P. Beer and E. R. Johnson Jr, Vector Mechanics for Engineers, McGraw Hill, 2009.
3. J. S. Rao and K. Gupta, Introductory Course on Theory and Practice of Mechanical Vibrations, New Age International, 1999.

## **CE102 BASIC ENERGY, ENVIRONMENT AND AGRICULTURAL ENGINEERING**

**Unit-I:** Present energy resources in India and its sustainability - Different type of conventional power plant-Energy demand scenario in India - Advantage and disadvantage of conventional Power Plants – Conventional vs. non-conventional power generation - Basics of Solar Energy- Solar thermal and Solar photovoltaic systems

**Unit-2:** Power and energy from wind turbines-Types of wind turbines-Biomass resources-Biomass conversion technologies- Feedstock pre-processing and treatment methods-- Introduction to geothermal energy and tidal energy.

**Unit-3:** Air pollution - Sources, effects, control, air quality standards -Air pollution act, air pollution measurement. Water pollution-Sources, impacts, control, and measure –Quality of water for various purposes-Noise pollution - Sources, impacts, control, measure.

**Unit-4:** Pollution aspects of various industries- Impacts of fossil fuels and transport emissions – impacts - Municipal solid waste generation and management - Swachh Bharat Mission – Challenges and activities - Environment and forest conservation - Greenhouse gases and global warming- climate change

**Unit-5:** Introduction to agriculture engineering -Major crops of India–Types and categories of crops-Types of farming and cultivation procedures-Different monsoon seasons-Types of irrigation systems-Major draughts-Agricultural machinery-Dairy farming and its economic importance

### **TEXT BOOKS**

1. B. H. Khan, Non-Conventional Energy Resources-The McGraw –Hill Second edition, 2009.
2. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Prentice Hall, 2nd Edition, 2003.
3. G.L. Asawa, Elementary Irrigation Engineering, New Age International, First Edition, 2014
4. Sukhpal Singh, Agricultural Machinery Industry in India, Allied Publishers, New Delhi, 2010
5. Dilip R. Shah, Co-Operativization Liberalization And Dairy Industry In India, A.B.D. Publishers, 2000

### **REFERENCES**

1. Unleashing the Potential of Renewable Energy in India –World bank report.
2. G. Boyle, Renewable energy: Power for a sustainable future, Oxford University press, 2004.

## **SOPHOMORE YEAR**

### **SEMESTER-III**

#### **CE201 MECHANICS OF SOLIDS**

**Unit-1:** Mechanical properties of materials - Stress-strain diagrams - Elastic and plastic deformation - Brittle and ductile failures of materials - Mechanical tests like surface hardness, fatigue, creep etc. Tension, compression and shear stresses - Hooke's law - Elastic constants - Compound stresses - Composite bars

**Unit-2:** Strain energy due to axial force - Resilience - stresses due to impact and suddenly applied load -Principal stress and principal planes - Mohr's circle

**Unit-3:** Beams and support conditions - Types of supports and loads - shear force and bending moment - their diagrams for simply supported beams, cantilevers and overhanging beams. Theory of simple bending - Stress distribution at a cross section due to bending moment and shear

**Unit-4:** Analysis of plane truss - Method of joints - Method of sections-Tension coefficient method

**Unit-5:** Theory of torsion - Torsion of circular and hollow circular shafts and shear stresses due to torsion -Closed and open coiled helical springs - Leaf spring- Strain energy- Thin cylinders and shells.

#### **Text Book:**

1. Punmia, B.C., Strength of Materials Part II, Standard Publishers and Distributors, 1991.
2. Rajput, R.K., Strength of Materials, S. Chand Ltd, 2006.
3. Bansal, R.K., Strength of Materials, Laxmi Publications, 2010

#### **References**

1. Vazirani, V.N. and Ratwani, N.M., Strength of Materials, Vol I, Khanna Publishers, 1996.
2. Kazimi, Mechanics of Solids, Tata McGraw - Hill, 2004.
3. Timoshenko, S.P. and Gere, J.M., Mechanics of Materials, Tata McGraw Hill, 1992.
4. Shames I.H., Engineering Mechanics, Prentice Hall of India,1996

#### **CE203 MECHANICS OF FLUIDS**

**Unit-1:** Continuum concept - CGS, MKS and SI systems - Properties of fluids - Ideal and real fluid - Pressure at a point – Pressure variation - Pressure measurement-Hydrostatic forces on plane and curved surfaces - Buoyancy and equilibrium - Metacentric height and its determination

**Unit-2:** Types of flow - Continuity equation for one, two and three dimensional flows - Stream function and velocity potential - Flow net and its properties - Convective and local acceleration - Pressure, kinetic and datum energy - Bernoulli's theorem and proof

**Unit-3:** Euler's equations of motion for a three dimensional flow and along a streamline - Deduction of Bernoulli's theorem- Momentum equation – Applications - Reynold's experiment - Laminar and turbulent flow - Reynold's number - Critical flow

**Unit-4:** Navier Stoke equations of motion - Shear stress and pressure gradient - Laminar flow between parallel plates - Couette flow - Hagen Poiseuille equation for flow through circular pipes - Turbulence - Semi empirical theories – Major losses – Darcy Weisbach equation for flow through circular pipe

**Unit-5:** Friction factor - Smooth and rough pipes - Moody diagram - Flow through noncircular pipe -Minor losses - Pipes in series and parallel - Equivalent length - Introduction to water hammer phenomena.

### **Text Book:**

1. Nagaratnam, S., Fluid Mechanics, Khanna Publishers, 1995.
2. Rajput R.K., Fluid Mechanics And Hydraulic Machines, S. Chand Ltd, 1998

### **References**

1. Natarajan, M.K. Principles of Fluid Mechanics, Oxford & IBH Publishing Co, 1994.
2. Jagdish Lal, Hydraulics and Fluid Mechanics, Tata McGraw Hill, 2001.
3. Streeter V.L., Fluid mechanics, Tata McGraw Hill, 1998.

## **CE205 SURVEYING**

**Unit-1:** Introduction and principles of surveying – Classification – Brief introduction to chain surveying – Chaining and ranging - Compass surveying – Prismatic compass only – Instruments – Bearing of survey lines – Systems and conversions – Local attraction – Latitude and departure – Traversing – Traverse adjustment of closing errors.

**Unit-2:** Plane table surveying – instruments and accessories – advantages and disadvantages of plane table surveying – methods – radiation, intersection, traversing, resection – Two and three point problems – errors in plane table surveying.

**Unit-3:** Levelling – Definitions – Levelling instruments – Temporary and permanent adjustments – Booking – Reduction to levels – Correction for Curvature and refraction – Classification of levelling – Profile levelling – Differential levelling – Reciprocal levelling – longitudinal and cross sectioning - Contours – Contour interval – Methods of contouring – uses.

**Unit-4:** Theodolite surveying – Vernier theodolite – Temporary and permanent adjustments – Measurement of horizontal and vertical angles – Methods of repetition and reiteration – errors in theodolite surveying – elimination of errors - Area and volume computation – area from latitude and departure Simpson's rule and Trapezoidal rule.

**Unit-5:** Tachometric surveying – Principles – Methods – Stadia system – Fixed and movable hair methods – Methods with staff held vertical and normal – Analytic lens – Subtense bar – Tangential method.



## **Text Book**

1. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2004.

## **References**

1. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 1994.
2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 1996

## **CE207 GEOTECHNICAL ENGINEERING**

**Unit-1:** Historical development of Soil Engineering - Origin and general types of soils - soil structure, clay minerals-Three phase system- Identification and classification of soils Soil water - Capillary phenomena concept of effective and neutral stresses.

**Unit-2:** Permeability-Determination of coefficient of permeability in the laboratory - Seepage flow - Head, gradient, pressure - Steady state flow - Two dimensional - Flow net.

**Unit-3:** Vertical stress distribution in soil - Boussinesq and Westergaard's equation - Newmark's influence chart - Principle, construction and use - Equivalent point load and other approximate methods - Pressure bulb - Compaction

**Unit-4:** Shear strength - Mohr-Coulomb failure criterion - Shear strength tests Different drainage conditions - Shear properties of cohesion less and cohesive soils - Use of Mohr's circle - relationship between principal stresses and shear parameters.

**Unit-5:** Compressibility and consolidation - One dimensional consolidation theory - Pressure void ratio relationship - Preconsolidation pressure - Total settlement and time rate of settlement - Coefficient of consolidation - Curve fitting methods - Correction for construction time.

## **Text Book:**

1. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2. Murthy, V.N.S., A text book of Soil Mechanics and Foundation Engineering, UBS Publishers Distributors Ltd., New Delhi, 1999.

## **References**

1. Gopal Ranjan and Rao, P. Basic and Applied Soil Mechanics, New Age International Pvt. Limited, New Delhi, 2002.
2. Braja M. Das, Fundamentals of Geotechnical Engineering, Thomson Asia Pvt. Ltd., Singapore, 2005.

## **CE209 BUILDING PLANNING AND DRAWING**

Classification of buildings - Principles of planning - Dimensions of buildings - Building bye-laws for floor area ratio, open spaces - Orientation of buildings - Lighting and Ventilation-

Planning and preparing sketches and working drawings of Residential buildings (Flat and sloping roof), Schools, Hostels, Hospitals, Factory buildings with trusses. Detailed working drawings of the component parts - Doors and Windows - Roof Trusses - Staircases  
Note: This entire course will be taught using the popular drafting software package 'AutoCAD'.

## References

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

### CE211 MATERIAL TESTING LAB

1. Test on springs
2. Torsion test
3. Tension test
4. Hardness test
5. Tests on bricks
6. Tests on concrete cubes
7. Tests on wood
8. Impact test
9. Test on aggregates

### CE213 SURVEY LAB

1. Experiment on plane table surveying
2. Experiment on levelling
3. Experiment on theodolite surveying
4. Experiment on single plane observation of trigonometrical levelling
5. Experiment on two plane method
6. Experiment on determination of tachometric constants
7. Experiment on tangential tachometry
8. Experiment on Subtense bar
9. Total station basics

## SEMESTER-IV

### CE202 STRENGTH OF MATERIALS

**Unit-1:** Principle of virtual displacement and virtual forces - Castigliano's first theorem - Maxwell's reciprocal theorem. Theories of failure - Criteria for Failure - Different failure theories for ductile and brittle materials.

**Unit-2:** Determination of deflection curve of beams - double integration - Macaulay's method - Area moment method- Conjugate beam method - strain energy and dummy unit load approaches to deflection of Simple and Curved members.

**Unit-3:** Statically indeterminate structures - Propped cantilever, fixed and continuous beams - Theorem of three moments- Bending moment and shear force diagrams

**Unit-4:** Thick cylinders - Lamé's equation - Shrink fit - Compound cylinders. Deflection of trusses-Dummy unit load method - Strain energy method - Williot Mohr's diagram

**Unit-5:** Theory of columns: Axial load- Euler's theory-Rankines formula, Johnson's formula, combined bending and axial load

**Text Book**

1. Rajput R.K., Strength of Materials, S. Chand & Co., Ltd., 1996.

**References**

1. Vazirani, V.N. and Ratwani, N.M. Strength of Materials, Vol. II, Kanna Publishers, 1996.
2. Timoshenko, S.P. and Gere, J.M. Mechanics of Materials, Tata McGraw Hill, 1992
3. Srinath, L. S., Advanced Mechanics of Solids, Tata McGraw Hill, 1980.

**CE204 FLUID FLOW AND HYDRAULIC MACHINERY**

**Unit-1:** Ideal fluid flow- Uniform flow- Source - Sink- Doublet - Combination of flow patterns - Uniform flow and source- Flow around cylinder - Flow with circulation - Lift. Boundary layer - Displacement and momentum thickness

**Unit-2:** Flow in circular pipes - Von Karman momentum equation - Laminar and turbulent boundary layers on flat plates - Drag in flat plates, cylinders and spheres - Drag coefficients - Boundary layer control. Open Channel Flow - Classification - Terminology - velocity distribution in open channels

**Unit-3:** Chezy, Manning and other formulae - Best hydraulic section - Specific energy - Specific force - Hydraulic jump and its characteristics - Gradually varied flow - Computation of surface profiles. Velocity measurement with Pitot tube, Prandtl Pitot tube and current meter

**Unit-4:** Discharge measurement in pipe flow - Venturi meter, mouthpiece, orifice meter, nozzle meter, bend meter and rotameter - Discharge measurement in open channel flow - All types of notches and weirs, venture flume - Critical depth meter - Basic principles.

**Unit-5:** Hydraulic machineries-Centrifugal pump-Submersible pump-Reciprocating pump-Jet pump-Gear pump-Screw pump-Francis Turbine-Working principles-velocity triangles-efficiency.

**Text Book:**

1. Nagaratnam, S. Fluid Mechanics, Khanna Publishers, 1989.

**References**

1. Streeter, V.L. Fluid Mechanics, Tata McGraw Hill, 1998.
2. Chow, V.T. Open Channel Hydraulics, Tata McGraw Hill, 1975.

## CE206 FOUNDATION ENGINEERING

**Unit-1:** Soil exploration - Planning - Auger boring - Soundings - Sampling - Plate load test, static and dynamic penetrations tests - Geophysical explorations

**Unit-2:** Lateral Earth Pressure - Plastic equilibrium - Rankine's theory - Active and passive earth pressure for cohesionless and cohesive soils - Earth pressure at rest - Coloumb's wedge theory - Rebhann's and Culmann's graphical solutions, Stability analysis foundation - Functions and requisites- Different types - Choice of foundation type – General principles of design.

**Unit-3:** Bearing capacity - Types of failures - Prandtl's and Terzaghi's bearing capacity analysis -Bearing capacity based on settlement and building codes

**Unit-4:** Shallow foundation - Spread footings - Combined footings - Trapezoidal and strap footings - Raft foundation- Contact pressure distribution - Settlement analysis - Types of settlement

**Unit-5:** Deep foundation - Piles - Types - Load carrying capacity of pile - Static and dynamic formula - Pile load test - Penetration test - Pile groups - Efficiency - Feld's rule - Converse Labarre formula, Settlement of piles and pile groups - Negative skin friction

### Text Book:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2. Murthy, V.N.S, A text book of Soil Mechanics and Foundation Engineering, UBS Publishers & Distributors Pvt. Ltd., New Delhi 1999.

### References

1. Gopal Ranjan and Rao, Basic and Applied Soil Mechanics, New Age International (P) Limited, New Delhi, 2002.
2. Braja M. Das, Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., Singapore, 2005.

## CE208 BUILDING MATERIALS AND CONSTRUCTION

**Unit-1:** Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, Concrete blocks – Lightweight concrete blocks-Solid and Hollow.

**Unit-2:** Mortar and concrete: Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High

Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete.

**Unit-3:** Introduction to new materials: Plywood – Veneer – Thermacole – Panels of laminates – Steel - Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers .

**Unit-4:** Load Bearing Structure: Masonry-Stone-Brick-Wall-English Bond-Flemish Bond Vertical Joints-Plastering-Pointing-Weathering coarse-Lintels-Windows-Doors-Openings-Sizes-Flooring-Construction Joints-Expansion joints-Building foundation-temporary sheds-basements.

**Unit-5:** Frames Structure: Beam-Columns-Slabs-Form work-Reinforcement-Foundations-Types-Applications-Construction procedure.

**Text Book:**

1. R.K. Gupta, Civil Engineering Materials and Construction Practices, Jain brothers, New Delhi, 2009.

**References**

1. M. Gambhir, Neha Jamwal, Building Materials Products, Properties and Systems, Tata McGraw Hill Publishers, New Delhi, 2011.
2. National Building Code of India 2005, Bureau of Indian Standards, 2005.
3. Tech. Teachers Training Institute, Civil Engineering Materials, Tata McGraw Hill, 1992.

**CE210 GEOTECHNICAL ENGINEERING LAB**

1. Grain Size analysis
2. Consistency limits
3. Specific gravity
4. Permeability tests
5. Unconfined compression test
6. Direct shear test
7. Core cutter and sand replacement
8. Compaction test
9. California bearing ratio test
10. Vane shear test
11. Triaxial test
12. Consolidation test

**CE212 FLUID MECHANICS LAB**

1. Determination of pipe friction
2. Calibration of flow meters - Venturimeter and Orifice meter
3. Determination of discharge coefficients for notches
4. Determination of minor losses

5. Pressure gauge calibration.
6. Centrifugal pump
7. Submersible pump
8. Reciprocating pump
9. Jet pump
10. Gear pump
11. Screw pump
12. Francis Turbine

# **JUNIOR YEAR**

## **SEMESTER-V**

### **CE301 ANALYSIS OF INDETERMINATE STRUCTURES**

**Unit-1:** Slope deflection method - Moment distribution method - Settlement of supports – sway- Energy methods - Kani's method - Settlement of supports - Sway.

**Unit-2:** Theory of arches - Analysis of three hinged, two hinged and fixed arches - Influence lines, rib shortening, settlement and temperature effects.

**Unit-3:** Moving loads for statically determinate structures - Single load - Two point loads - Several points loads - Maximum bending moment and maximum shear force - Equivalent UDL - Absolute maximum bending moment.

**Unit-4:** Enveloping curves for maximum bending moment and maximum shear force, ILD for shear, moment and reactions for statically determinate beams and pin jointed trusses - Reversal of stresses under live load.

**Unit-5:** Analysis of plane truss with one or two redundant - Trusses with lack of fit - Thermal stresses -Settlement of supports - Trussed beams.

#### **Text book**

1. Punmia B.C., Theory of Structures, Standard Book House, New Delhi, 2000
2. Ramamrutham S. & Narayanan R., Theory of structures, Dhanpatrai Publications, 1983

#### **References**

1. Jindal. R.L, Indeterminate Structures, Chan Tea, New Delhi, 2000

### **CE303 BASIC DESIGN OF CONCRETE STRUCTURES**

**Unit-1:** Stress strain behaviour of steel and concrete- Introduction to working stress method - Permissible stresses. Limit state method-Limit states - Characteristic strength and load - Partial safety factor

**Unit-2:** Design of singly and doubly reinforced beams, T and L beams - Design for Shear and Torsion.

**Unit-3:** Slabs – one way and two way slabs for different edge conditions - Yield line theory - Flat slab - Continuous slabs

**Unit-4:** Stair cases - Different types, Columns - axially loaded and eccentrically loaded columns - Interaction Diagrams.

**Unit-5:** Footings - Isolated footings - square, rectangular and circular footings - Combined footing-Raft Footing - Pile and pile cap

#### **Text book:**

1. PC Varghese, Limit state design of concrete, Oxford IBH, 2000.

2. Pillai and Menon , Concrete Structures, TMH,2000

### References:

1. Ashok, Kumar Jain, Reinforced Concrete Limit State Design, Nem Chand Brothers, 1990.
2. Sinha. S.N. Reinforced Concrete Design, Tata McGraw Hill, 2002.
3. IS456-2000 Code of practice for Plain and reinforced concrete code of practice.

### CE305 BASIC DESIGN OF STEEL STRUCTURES

**Unit-1:** Introduction to steel structures and IS800 -2007- Material specifications - Rolled sections – Section classifications - Permissible stresses in tension, compression, bending and shear.

**Unit-2:** Compression members - Slenderness ratio – Design - Simple and built-up sections - Lacing and battens - Tension members.

**Unit-3:** Bolted connections - types of bolts - Resistance of bolted connections under various failure modes – Design of beam splice, seated shear connections at the supports.

**Unit-4:** Welded connections - types - Strength of welds - Design of fillet and butt welds - Shear and moment resistant joints - Design and detailing of connections.

**Unit-5:** Flexural members – Rolled sections - built-up beams - Design for strength and serviceability, web crippling, web yielding, bearing stiffeners. Roof trusses - components - Loads - Design of purlins for truss members - End connections at the supports.

### Text Book

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain. Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., New Delhi 2000.
2. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi 2008.

### References

1. Dayaratnam P, Design of Steel Structures, S. Chand & Co., New Delhi, 2003.
2. Arya, A.S and Ajmani, A.L., Design of Steel Structures, Nemchand and brothers, Roorkee, 1992.
3. IS 800-2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.

### CE307 TRANSPORTATION ENGINEERING

**Unit-1:** Introduction: Importance of transportation, Different modes of transportation, Characteristics of road transport, Scope of highway and traffic engineering

**Unit-2:** Highway development and planning: Importance, classification of roads, road patterns, planning surveys; highway alignment and surveys - Highway geometric design: Cross section elements, sight distance, design of horizontal and vertical alignment



**Unit-3:** Traffic Engineering: Traffic characteristics - Traffic studies-speed, Volume, speed and delay, origin destination, parking and accident studies; Capacity of urban roads and highways;

**Unit-4:** Traffic operations regulation and control; Design of intersections

**Units-5:** Grade and grade separated Pavement materials and design: Specifications and tests on pavement materials, pavement design factors, design of flexible and rigid pavements as per IRC.

#### **Text book**

1. Khanna, S.K and Justo, C.E.G., Highway Engineering, New Chand and Bros, 2001.

#### **References**

1. Kadiyali, L.R, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 1987
2. Kadiyali LR and NB Lal, Principles and Practise of Highway Engineering, Khanna Publishers, 1984

### **CE309 WATER SUPPLY ENGINEERING**

**Unit-1:** Physical, chemical and biological characteristics of water - water analysis- IS and WHO standards- Requirements of water supply

**Unit-2:** Types of demand and their contribution - Rate of consumption - Forecasting the population- variation in demand pattern. Sources of water - Quantitative and qualitative studies. Intakes – Channels and pipes for conveying water

**Unit-3:** Pipes- hydraulic design of pressure pipe- Materials - laying- joining- testing - pipe appurtenances- Pumps and pumping stations - Treatment plants

**Unit-4:** Process of treatments - mixing, aeration, sedimentation, coagulation, filtration, disinfection, softening - advanced water treatment.

**Unit-5:** Distribution systems – analysis of distribution networks. Operation and maintenance of water supply to buildings - Rural water supply - Protected water supply -Saline water intrusion.

#### **Text Book**

1. Duggal, K.N. Elements of Environmental Engineering, S.Chand & Co, 2002.

#### **References**

1. Manual on Water supply and Treatment - CPHEEO, 1999
2. Birdie, G.S. and Birdie, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons, 1992.
3. Punmia B.C, Ashok Jain & Arun Jain, Water Supply Engineering, Laxmi Publications, Pvt. Ltd., New Delhi, 2004.

## CE311 WATER RESOURCES ENGINEERING

**Unit-1:** Hydrologic cycle - rainfall and its measurement - computation of mean rainfall over a catchment area using arithmetic mean, Thiessen polygon and Isohyetal methods - Runoff -infiltration indices -

**Unit-2:** Storm Hydrograph and unit hydrograph River regions and their characteristics - classification of rivers on alluvial plains - meandering of rivers -river training Reservoir planning - Investigations - zones of storage in a reservoir - single purpose and multipurpose reservoir -

**Unit-3:** determination of storage capacity and yield - reservoir sedimentation - Reservoir life -Sediment prevention - Flood estimation- Flood forecasting - Flood routing Ground water - types of aquifers - storage coefficient - coefficient of transmissibility - :

**Unit-4:** steady radial flow into a well located in an unconfined and confined aquifers - Tube wells and Open wells - yield from an open well. Water logging - causes and effects of water logging - remedial measures - land reclamation

**Unit-5:** Land drainage - benefits - classification of drains - surface drains - subsurface drains - design principles and maintenance of drainage systems.

### Text book

1. Punmia, B.C., Irrigation and Water Power Engineering, Standard Publishers, 2001.

### References

1. Rangunath. H.M., Hydrology, Willey Eastern Limited, New Delhi, 2000.
2. Subramanya, Engineering Hydrology, Tata-McGraw Hill, 2004.

## CE313 CONCRETE TECHNOLOGY LAB

1. Consistency of cement
2. Setting time of cement
3. Specific gravity test on aggregates
4. Fineness modulus test on aggregates
5. Percentage of voids test on aggregates
6. Bulk density test on aggregates
7. Slump cone test for fresh concrete
8. Flow table test for fresh concrete
9. Compaction factor test for concrete
10. Vee Bee test for concrete
11. Compressive strength of concrete – Cubes and Cylinders
12. Tensile strength of concrete
13. Flexure test of concrete
14. Concrete mix design
15. Non-Destructive tests on concrete

## CE315 WATER TESTING LAB

1. Physical characteristics of water
2. Chemical characteristics of water
3. Bacteriological tests
4. Microscopic tests
5. Jar test
6. Chlorine demand and residual test
7. Total solids and settle able solids.
8. Organic and inorganic solids.
9. Determination of pH and chemical constituents like Cl-Fe<sup>2+</sup>+etc
10. Turbidity of water
11. Test for Manganese
12. Test for Iron

### SEMESTER-VI

#### CE302 ADVANCED DESIGN OF CONCRETE STRUCTURES

**Unit-1:** Earth Retaining structures - Retaining walls- types - cantilever and counterfort - design - drainage and other construction details.

**Unit-2:** Liquid Retaining structure - Water tanks - types - square, rectangular, circular - Design of underground and elevated tanks - design of staging - spherical & conical roof for circular tanks.

**Unit-3:** Material storage structures - Determination of lateral pressure on side walls of bunker - Rankine's theory - design of bunker - design of circular silo using Jansen's theory.

**Unit-4:** Environmental Structures - Chimneys - Principles and Design - Design of long columns.

**Units-5:** Transportation structures - Bridges - Slab Bridge - Design of single span slab bridge - Tee Beam Bridge - Design of Tee Beam Bridge with stiffness - Tee beam bridge with cross girders

#### **Text book**

1. Dayaratnam, P., Design of Reinforced Concrete Structures, Oxford & IBH Publishers & Co., New Delhi, 2005.

#### **References**

1. Vazirani, V.N., and Ratwani, Concrete Structures, Vol. IV, Khanna Publishers, New Delhi, 1995.
2. Victor, D.J., Essentials of Bridge Engineering, Oxford & IBH Publishers Co., Newdelhi, 1990.
3. IS456-2012 Code of practice for Plain and reinforced concrete code of practice
4. SP 16: Design Aids for Reinforced Concrete to IS 456:1978

## **CE304 COMPUTER AIDED DESIGN LAB**

### **Part-1: Developing computer programs in MATLAB for basic problems**

1. Roots of an equation using Newton - Raphson method.
2. Solution of linear simultaneous equations using Gauss elimination.
3. Matrix inversion using Gauss Jordan method
4. Linear regression line of given points
5. Curve fitting using Polynomial Regression
6. Eigen value extraction using Power method

### **Part-2: Commercial Software Application for civil engineering design**

1. Building & bridges design using STADD Pro
2. Highway and railway design using BENTLEY Road Analysis & Design Software
3. Geotechnical analysis using PLAXIS
4. Pipe networks and canal design using Water NET-CAD

### **Part-3: Commercial Software Application for complex analysis**

1. Analysis of structural elements using ABAQUS
2. Analysis of soil structure using PLAXIS
3. Analysis of traffic flow and drainage design INFRAWORK 360

### **References**

1. Chapra, S.C., and Canale R.P., Numerical Methods for Engineers, McGraw-Hill, 2004
2. Rajasekaran, S., Numerical Methods in Science and Engineering A Practical Approach, A.H.Wheeler and Co, 2005.
3. Ronald W., Leigh, AutoCAD: A Concise Guide to Commands and Features, Galgotia Publications, 2004.

## **CE306 TRANSPORTATION ENGINEERING LAB**

1. Determination of crushing value of aggregates.
2. Determination of abrasion value by Los Angle's Machine.
3. Determination of abrasion value by Deval's Abrasion Machine.
4. Determination of Impact Value of aggregates.
5. Water Absorption of coarse aggregate.
6. Determination of Softening Point of Bitumen.
7. Determination of Ductility Value of Bitumen.
8. Determination of Viscosity Value of Bitumen.
9. Determination of Elongation Index of Aggregate.
10. Determination of Flakiness Index of aggregate.

11. Determination of Penetration Value of Bitumen.
12. Flash and Fire Point Test.
13. Study of Marshal Stability Test.
14. Study of Benkelman Beam.
15. Study of bump Integrator
16. Study of Field CBR

## **SUMMER TERM**

### **CE308 INDUSTRIAL TRAINING**

An industrial training has to be pursued by the student for about 90 hours (3 weeks) in any construction / research institute / related software industry and a detailed report should be submitted. Upon evaluation of the report grade of the course will be awarded. The grades are satisfactory (C), good (B) and excellent (A).

## **SENIOR YEAR**

### **SEMESTER-VI**

#### **CE491 PROJECT WORK PHASE I**

The objective of this course is to impart and improve the research capability of the student. This course conceives purely a research problem in any one of the disciplines of Civil Engineering; e.g., Behaviour of Beams, Assessing Land Slides, Analysis of Intelligent Traffic Intersection etc. The research problem can be pursued by an individual student or a group of students comprising of not more than three. Every student group has to find a research gap according to their interest by doing good amount of literature survey. Further, they should define the title and research problem. They should also start the work towards their objective of the research work. At the end of the course, the group should submit a report on literature survey done and research problem identification and expected outcomes.

#### **Evaluation procedure**

The method of evaluation will be as follows: I<sup>st</sup> Evaluation: 20 marks on finding research area (Decided by conducting a review by the department faculties) II<sup>nd</sup> Evaluation: 20 marks on literature collection and presentation (Decided by conducting a review by the department faculties). Final Evaluation: 60 marks on report for problem identification, literature survey and early works and expected outcomes (Decided by conducting final review by the department faculties).

### **SEMESTER-VIII**

#### **CE492 PROJECT WORK PHASE II**

With continuation to the course, CE491 PROJECT WORK PHASE I, the same group of students should pursue further research in the same original problem statement reported earlier. At the end of this CE492 Project Work Phase II course, the group should submit a full-length research investigation report consisting of the data collection, the analysis and design calculations, and outcomes if any along with required tables, pictures and figures.

#### **Evaluation procedure**

The method of evaluation will be as follows: I<sup>st</sup> Evaluation: 20 marks on further works (Decided by conducting a review by the department faculties) II<sup>nd</sup> Evaluation of Project Report: 20 marks on balance works (Decided by conducting a review by the department faculties). Final Evaluation: 60 marks on complete research work (Decided by conducting final review by the department faculties along with an external expert appointed by the Institution).

## ELECTIVES COURSES OFFERED IN VI<sup>th</sup> SEMESTER

### **CE502 ADVANCED METHODS OF STRUCTURAL ANALYSIS**

**Unit-1:** Influence lines-Maxwell Betti's theorem - Muller Breslau's principle and its application. Influence lines for continuous beams and single bay, single storey portals with prismatic members.

**Unit-2:** Analysis of cables - Suspension bridges with three and two hinged stiffening girders - influence lines Analysis of multi-storey frames for gravity and lateral loads by approximate methods - Substitute frame -Portal and Cantilever methods.

**Unit-3:** Strain energy - Stiffness and flexibility matrices from strain energy - Symmetry and other properties of stiffness and flexibility matrices

**Unit-4:** Stiffness method of matrix analysis – beams – frames-stiffness matrices-properties-force vector

**Unit-5:** Flexibility method of matrix analysis – beams – frames-flexibility matrices-displacement vector

#### **Text book**

1. Wang. C.K., Intermediate Structural Analysis, International Text Book Co, 1983.
2. C. Natarajan and Revathi P, Matrix Methods of Structural Analysis: Theory and Problems, PHI India, 2014.

#### **References**

1. Punmia, B.C, Theory of Structures, Laxmi Publications, 2000.
2. Timoshenko, S.P.,Young, D.H., Theory of Structures, Tata McGraw Hill, 1983.
3. Hibbeler. R.C., Structural Analysis, Pearson Education (Singapore) Ptc. Ltd., Indian Branch, 2002.

### **CE504 BRIDGE ENGINEERING**

**Unit-I:** Introduction - Design of through type steel highway bridges for IRC loading - Design of stringers, cross girders and main girders - Design of deck type steel highway bridges for IRC loading - Design of main girders

**Unit-II:** Steel Bridges - Design of pratt type truss girder highway bridges - Design of top chord, bottom chord, web members - Effect of repeated loading - Design of plate girder railway bridges for railway loading - Wind effects - Design of web and flange plates - Vertical and horizontal stiffeners.

**Unit-III:** Reinforced Concrete Girder Bridges - Design of tee beam - Courbon's theory - Pigeaud's curves

**Unit-IV:** Design of balanced cantilever bridges - Deck slab - Main girder - Design of cantilever - Design of articulation.

**Unit-V:** Analysis and design hanging suspension bridges-analysis and design of cable stay bridges-Applications of commercial software

## References

1. Johnson Victor D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Co., New Delhi, 1990.
2. Rajagopalan, N. Bridge Superstructure, Alpha Science International, 2006
3. Phatak D.R., “Bridge Engineering”, Satya Prakashan, New Delhi, 1990.
4. Ponnuswamy S., “Bridge Engineering”, Tata McGraw-Hill, New Delhi, 1996.

## CE506 ADVANCED SURVEYING

**Unit-1:** Curve setting – Horizontal curves - Elements of simple and compound curves – Methods of setting out – Reverse curve – Transition curve – Length of curve – Elements of cubic parabola, true spiral and cubic spiral

**Unit-2:** Vertical curve – parabola – Setting out of buildings – Culverts – Tunnels. Triangulation – different networks – orders and accuracies – Intervisibility and height of stations – Signals and towers – Baseline measurement – Instruments and accessories – tape corrections – extension of baseline – satellite stations

**Unit-3:** Reduction to centre. Trigonometrical levelling – Observations for heights and distances – Geodetic observations – Corrections for refraction, curvature, axis signal – Reciprocal observations. Errors – Types of errors – Theory of least squares

**Unit-4:** Weighted observations – Most probable value – Computations of indirectly observed quantities – Method of normal equations – Conditioned quantities, method of correlates, method of differences – Adjustment of simple triangle and quadrilateral network without central station. Electromagnetic distance measurement (EDM)

**Unit-5:** Principle – Types – Total station - Photogrammetry – Terrestrial and aerial photographs – Photo interpretation – Stereoscopy - Remote sensing – Principle – Idealized remote sensing system – Types – applications - Introduction to GPS – Segments – Principle of working – application.

### Text Book

1. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2004.

## References

1. Punmia, B.C. Surveying Vol. I and II, Standard Publishers, 1994.
2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 1996.
3. Satheesh Gopi. Advanced Surveying, Pearson Education, 2007.
4. Satheesh Gopi. The Global Positioning System and Surveying using GPS, Tata McGraw, 2005.

## CE508 GROUND IMPROVEMENT TECHNIQUES

**Unit-1:** Need and Scope - Principles of Ground Modification - Mechanical Methods and their Suitability



**Unit-2:** Hydraulic Modification by Well Point Methods - Electro osmosis and pre loading techniques; Physical and Chemical-Dynamic Consolidation

**Unit-3:** Modifications by Using Different Admixtures; Soil Reinforcement Principles and Technology - Ground Anchors – Stone Columns

**Unit-4:** Soil Nailing - Soil confinement Applications – Micro Piling

**Unit-5:** Geotextiles - Overview - Properties - Functions and Applications.

## References

1. Bell, F.G., Engineering Treatment of Soils, Taylor and Francis, New York, 1993.
2. Manfred R. Haussmann, Engineering Principles of Ground Modification, McGraw Hill Pub. Co., New York, 1990.
3. Purushothama Raj, P, Ground Improvement Techniques, Laxmi Publications (P) Limited, 2005.

## CE510 EARTH AND EARTH RETAINING STRUCTURES

**Unit-1:** Introduction - Earth dams – types of dams – selection of type of dam based on material availability – foundation conditions and topography - Design details – crest, free board, upstream and downstream slopes, upstream and downstream slope protection – central and inclined cores – types and design of filters - Seepage analysis and control – seepage through dam and foundations – control of seepage in earth dam and foundation

**Unit-2:** Stability analysis – critical stability conditions – evaluation of stability by Bishop's and sliding wedge methods under critical conditions Construction techniques – methods of construction – quality control - Instrumentation – measurement of pore pressures

**Unit-3:** Earth pressure theories – Rankine's and Coulomb's earth pressure theories for cohesion less and cohesive backfills – computation of earth pressures for various cases – inclined – with surcharge – submerged and partly submerged – stratified backfills - Rigid retaining structures – active and passive earth pressures against gravity retaining walls – Surcharge - computation of earth pressures by Trial wedge method –

**Unit-4:** Mathematical approach for completely submerged and partly submerged backfills – importance of capillarity tension in earth pressure. Graphical methods of earth pressure computation – trial wedge method for coulomb's and Rankine's conditions, for regular and irregular ground and wall conditions – Rebhan's construction for active pressure – friction circle method – logarithmic spiral method. Design of gravity retaining wall – cantilever retaining walls

**Unit-5:** Flexible retaining structure – type and methods of construction – design strength parameters – safety factor for sheet pile walls – computation of earth pressures against cantilever sheet piles in cohesion less and cohesive soils – anchored sheet piles – free earth method – fixed earth method – Rowe's moment reduction method – stability of sheet piling Diaphragm walls and coffer dams – type of diaphragm walls and their construction techniques in various soil types – earth pressure on braced cuts and coffer dams – design of coffer dams

## References

1. Clayton, Milititsky and Woods, Earth Pressure and Earth-Retaining Structures, Taylor and Francis, 1996
2. Huntington, Earth pressure on retaining walls, John Wiley and Sons, 1957.
3. Bowles, Foundation Analysis and Design, 1968.
4. Jones, Earth Reinforcements and Soil structures, 1996.
5. Prakash, Ranjan and Saran, Analysis and Design of Foundations and Retaining structures, Saritha Prakashan, Meerut, 1977.

## CE512 ENVIRONMENTAL ENGINEERING

**Unit-1:** Characteristics and composition of sewage-sampling-analysis- population equivalent - drainage in-plumbing systems for drainage Primary treatment

**Unit-2:** Secondary treatment- biokinetics- Lagooning- sludge digestion-Tertiary treatment Disposal standards

**Unit-3:** Self-purification of rivers- Streeter Phelps equation - oxygen sag curve - Toxic and hazardous wastes

**Unit-4:** Equalization and neutralization- biological degradation- recycle and reuse of waste effluents - treatment of industrial wastes - Dairy, Tannery, Petrochemical, Fertilizer, Textiles, Pulp and paper

**Unit-5:** Air pollution-effects- stack emission- automobile exhaust - control devices-solid waste Management -EIA

### Text Book:

1. Duggal, K.N., Elements of Environmental Engineering, S.Chand and Co., New Delhi, 2002.

## References

1. Birdie, G.S. and Birdie, J.S., Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, New Delhi, 1992.
2. Metcalf and Eddy, Waste Water Engineering, Collection, Treatment and Disposal, Tata McGraw Hill, Inc., New York, 2005.
3. Manual of Sewage and Sewage Treatment - CPHEEO, 1999.

## CE514 SOLID AND HAZARDOUS WASTE MANAGEMENT

**Unit-1:** Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management Waste generation rates – Composition- Hazardous Characteristics – TCLP tests – waste sampling Source reduction of wastes – Recycling and reuse.

**Unit-2:** Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations - labelling and handling of hazardous wastes.

**Unit-3:** Waste processing – processing technologies – biological and chemical conversion technologies – Composting - thermal conversion technologies-energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes.

**Unit-4:** Disposal in landfills - site selection - design and operation of sanitary landfills-secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills – landfill remediation

**Unit-5:** Legislations on management and handling of municipal solid wastes, hazardous wastes, and biomedical wastes. Elements of Integrated waste management.

### References

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, Integrated Solid Waste Management, McGraw- Hill, New York, 1993 36
2. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.

## CE516 INDUSTRIAL WASTE MANAGEMENT

**Unit-1:** Sources and types of industrial wastewater – Environmental impacts – Regulatory requirements – generation rates – characterization – Toxicity and Bioassay tests.

**Unit-2:** Prevention Vs Control of Industrial Pollution– Source reduction techniques – Waste Audit- Evaluation of pollution prevention options.

**Unit-3:** Waste minimization - Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal – adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation

**Unit-4:** Ozonation – Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies - Individual and Common Effluent Treatment Plants – Zero effluent discharge systems - Wastewater reuse – Disposal of effluent on land.

**Unit-5:** Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – Metal finishing – Petroleum Refining – Pharmaceuticals – Sugar and Distilleries – Food Processing – Fertilizers – Thermal Power Plants and Industrial Estates, Waste Audit.

### References

1. Eckenfelder, W.W., Industrial Water Pollution Control, McGraw-Hill, 1999.
2. Arceivala, S.J., Wastewater Treatment for Pollution Control, McGraw-Hill, 1998.
3. Frank Woodard, Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi, 2001.

## CE518 RAILWAY, AIRPORT AND HARBOUR ENGINEERING

**Unit-1:** Railway Engineering - Location surveys and alignment - Permanent way - Gauges - Components -Functions and requirements - Geometric design

**Unit-2:** Track Junctions- Points and crossings - types and functions - design and layout - simple problems - Railway stations and yards. Signalling and interlocking - control systems of train movements.

**Unit-3:** Airport Engineering-Aircraft characteristics - Airport obstructions and zoning - Runway - taxiways and aprons- Terminal area planning

**Unit-4:** Docks and Harbours - Types - Layout and planning principles- breakwaters - docks- wharves and quays - Transit sheds- warehouses- navigation aids.

**Unit-5:** Urban transportation systems - Bus transit - Mass Rapid Transit System - Light Rail Transit. Transport economics and Financing - Intelligent Transportation Systems (ITS)

## References

1. M.M. Agarwal, Railway Engineering, Prabha & Co. 2007.
2. Khanna, S.K. and Arora, M.G. Airport Planning and Design, Nemchand and Bros. 1999.
3. Oza and Oza, Elements of Dock and Harbour Engineering, Charotar Publishing House, 1996.

## CE520 TRAFFIC ENGINEERING

**Unit-I:** Traffic Planning and Characteristics - Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town , country , regional and all urban infrastructure – Towards Sustainable approach – land use & transport and modal integration.

**Unit-II:** Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

**Unit-III:** Traffic Design and Visual Aids - Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.

**Unit-IV:** Traffic Safety and Environment - Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

**Unit-V:** Traffic Management - Area Traffic Management System - Traffic System Management (TSM) with IRC standards --Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

## References

1. Kadiyali.L.R. " Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013

2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
3. Salter . R.I and Hounsell N.B, " Highway Traffic Analysis and design", Macmillan Press Ltd.1996.
4. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
5. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
6. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
7. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesley Publishing Company , 1996
8. Hobbs.F .D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005
9. Taylor MAP and Y oung W, " Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.

## **CE522 PAVEMENT ENGINEERING**

**Unit-1:** Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airfield pavements, Requirements and desirable properties of aggregates, bitumen, emulsion and modified bitumen, Characterisation of different pavement materials

**Unit-2:** Pavement Design Factors Design wheel load, strength characteristics of pavement materials, climatic variations, traffic - load equivalence factors and equivalent wheel loads, aircraft loading, gear configuration and tyre pressure.

**Unit-3:** Drainage – Estimation of flow, surface drainage, sub-surface drainage systems, design of sub-surface drainage structures

**Unit-4:** Flexible Pavement Design Empirical, semi-empirical and theoretical approaches, design of highway and airport pavements by IRC, AASHTO Methods, Mechanistic – Empirical design, applications of pavement design software

**Unit-5:** Rigid Pavement Design Types of joints and their functions, joint spacing; design of CC pavement for roads, highways and airports as per IRC, AASHTO, design of joints. Design of continuously reinforced concrete pavements. Reliability; Use of software for rigid pavement design Pavement Management Distresses in pavements, maintenance of highways, structural and functional condition evaluation of pavements, performance prediction models, ranking and optimization in pavement management.

### **References**

1. Yoder and Witczak, Principles of Pavement Design, John Wiley and Sons, 1975
2. Yang. H. Huang, Pavement Analysis and Design, Second Edition, Prentice Hall Inc, 1993
3. Rajib B. Mallick and Tahar El-Korchi, Pavement Engineering – Principles and Practice, CRC Press, 2008
4. W.Ronald Hudson, Ralph Haas and Zeniswki , Modern Pavement Management, Mc Graw Hill and Co, 1978
5. Relevant IRC Codes

## CE524 IRRIGATION AND HYDRAULIC STRUCTURES

**Unit-1:** Irrigation - necessity - Types of irrigation - Methods of supplying water - Assessment of irrigation water - Consumptive use and its determination - water requirement of various crops - Duty - Delta - Base period and crop period.

**Unit-2:** Functions and components of a diversion head work - Function - selection of site - type of weirs on pervious foundations - cause of failure - Bligh's creep theory and Khosla's theory - complete design of a vertical drop weir.

**Unit-3:** Gravity dams - Non overflow section - forces acting - stability rules - elementary profile - Low and High dams - drainage gallery - Construction joints - Earthen dams - stability of slopes by slip circle method - seepage analysis and its control Types of canals -

**Unit-4:** Canal alignment - Kennedy's silt theory - Lacey's silt theory - Design of canals using the above theories - economical depth of cutting - canal losses - canal maintenance - lined canals and their design - silt control measures.

**Unit-5:** Canal falls - Necessity and location - Design of sand type fall - design of a cross regulator - cross drainage works - selection of suitable type of cross drainage work - canal outlets.

### Text Book

1. Garg, S.K., Irrigation and Hydraulics Structures, Khanna Publishers, 1992.

### References

1. Punmia, B.C., Irrigation and Water Power Engineering, Standard Publishers, 2001.
2. Sharma, S.K., Principles and Practice of Irrigation Engg, S.Chand & Co, 1984.

## CE526 HYDROLOGY

**Unit-1:** Precipitation circulation - temperature - Humidity – wind formation and forms of precipitation -Interpretation of precipitation data - snow cover and snow fall.

**Unit-2:** Factors affecting and methods of determining evaporation, infiltration and evapo-transpiration- Run-off cycle - factors affecting run-off -estimation of run-off by stream gauging - stage - discharge rating curves - Selection of site for a stream gauge station.

**Unit-3:** Derivation of unit hydrograph from complex storms - unit hydrographs for various duration - Synthetic unit hydrograph - Transposing unit hydrograph - Application of the unit hydrograph.

**Unit-4:** Linear Regression - Statistical and probability analysis of hydrological data - Flood frequency probability and stochastic methods

**Unit-5:** Basics of Stochastic and Deterministic models.

### References

1. Rangunath, H.M., Hydrology, Wiley Eastern, 1990.

## CE528 IRRIGATION MANAGEMENT

**Unit-1:** Command Area Development - Canal Irrigation and Management

**Unit-2:** Drainage of Excess Water – Livelihood and Production Thinking Philosophy

**Unit-3:** Optimal moisture content - Deficit Irrigation and Scheduling-Methods and Advantages

**Unit-4:** Salinity problems - Reclamation of salt affected soils- Classification of salt affected soils-Chemistry of salt affected soils-Nature and extent of salt problem in India-Determination of properties of Saline and Alkali soils-Reclamation and management of salt affected soils

**Unit-5:** Participatory Irrigation Management - Social Cost benefit analysis- Economic and Financial Analysis; Irrigation Project Costs; Study of actual evaluation of Irrigation Project

### References:

1. Asawa G.L, Irrigation Engineering, New Age Int., 2004.
2. Chambers R, Canal Management, Oxford IBH, 2002.

## CE 530 LAB ORIENTED MINI PROJECT

The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open-ended lab oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day-to-day productivity and punctuality of the students. A maximum of three students can pursue this project together under one guide.

Every student group has to plan an experimental program according to their interest in any one of the civil engineering field. Further, they should define the title and experimental plan. They should work towards their objective of the experimental plan. At the end of the course, the student group should submit a report on experimental program and outcomes.

### Evaluation Procedure

The method of evaluation will be as follows: I<sup>st</sup> Evaluation: 20 marks (Decided by conducting a review by the department faculties) II<sup>nd</sup> Evaluation of Project Report: 20 marks (Decided by conducting a review by the department faculties). Final Evaluation: 60 marks (Decided by conducting final review by the department faculties along with an external expert preferably from the industry).

## CE532 ESTIMATION COSTING AND VALUATION

**Unit– I:** Estimation and modes of measurement - Estimating - Types of estimate and data required - Overhead charges, contingencies, water charges, provisional sum, prime cost,

provisional quantities, spot items, day work. General rules for the measurements and its units of different items of civil engineering work.

**Unit– II:** Specifications of Civil works - Importance specifications-Types of specification-Principle of writing specification- Specification of earthwork in excavation, cement concrete, Brick masonry, R.C.C. work, Plastering Work, Painting, Flooring

**Unit– III:** Rate analysis of Civil Works - Task work and factors affecting it. Labour required for different works and labour rates - Market rates of construction materials - Schedule of Rates (SOR)-Rate analysis and factors affecting it rate analysis - Rate analysis for earthwork in excavation, P.C.C.Work, Brick masonry work, R.C.C. work, Plastering, Flooring work.

**Unit- IV:** Estimation of Civil works - Methods of detailed estimation – One / two room building - Two storied buildings (RCC footings, Column, beams, slab)- RCC retaining wall/ Culverts - Methods of calculating earthwork quantities for roads and canals

**Unit-V:** Valuation of Civil Engineering projects - Cost, price and value - Types of property and objects of valuation - Depreciation and obsolescence. - Different forms of value - Valuation tables and valuation methods for property and land - Types of rents and fixing standard rents

### **Text Book**

1. Dutta, Estimating and Costing in Civil Engineering, S. Datta & Co, 2002.

### **References**

1. Bhasin, P.L., Quantity Surveying, 2<sup>nd</sup> Edition, S.Chand & Co., 2000.
2. CPWD Hand Book

## **ELECTIVES OFFERED IN VII<sup>th</sup> SEMESTER**

### **CE501 ADVANCED DESIGN OF STEEL STRUCTURES**

**Unit-1:** Eccentrically loaded column - simple and compound section - lacings and battens - column bases – slab base – gusseted base – moment resistant base plate

**Unit-2:** Welded plate girders – analysis and design using IS800-2007 - curtailment of flange plates –stiffeners – analysis and design of gantry girder

**Unit-3:** Introduction to IS875 Part 3 – assessment of wind load – analysis and design of steel stacks -functional and structural requirements – self-supporting and guyed stacks - base plate and anchor bolt

**Unit-4:** Light gauge steel sections-types of cross section - Local and post buckling - Effective width concept Compression and Flexural members.

**Unit-5:** Introduction to Plastic analysis – ductility – plastic bending of beams – stages of bending – shape factor – plastic hinge – load factor – failure mechanism - upper and lower bound theorems of plastic analysis – collapse load for beams and frames.



## **Text book**

1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi 2008.

## **References**

1. Bhavikatti, S.S., Design of Steel Structures, I.K. International Publishing House Pvt. Ltd., New Delhi, 2010
2. Krishnaraju.N, Structural Design and Drawing, University Press, Hyderabad, 2009.
3. IS 800-2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.
4. IS 875 Part (3) - 1987, Code of Practice for Design Loads (other than earthquake) for buildings and structures: Wind loads., Bureau of Indian Standards, New Delhi.
5. SP6 (1)-1964, IS hand book for structural Engineers, Bureau of Indian Standards, New Delhi.

## **CE503 INTRODUCTION TO STRUCTURAL DYNAMICS, SEISMOLOGY & EARTHQUAKE RESISTANT STRUCTURES**

**Unit-1:** Theory of Vibrations - Difference between static loading and dynamic loading – Degree of freedom – idealisation of structure as single degree of freedom system – Formulation of Equations of motion of SDOF system - D'Alemberts principles – effect of damping – free and forced vibration of damped and undamped structures – Response to harmonic and periodic forces.

**Unit-2:** Multiple Degree Of Freedom System - Two degree of freedom system – modes of vibrations – formulation of equations of motion of multi degree of freedom (MDOF) system - Eigen values and Eigen vectors – Response to free and forced vibrations - damped and undamped MDOF system – Modal superposition methods.

**Unit-3:** Elements of Seismology - Elements of Engineering Seismology - Causes of Earthquake – Plate Tectonic theory – Elastic Rebound Theory – Characteristic of earthquake – Estimation of earthquake parameters - Magnitude and intensity of earthquakes – Spectral Acceleration.

**Unit-4:** Response of Structures to Earthquake - Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces - Response Spectra – Lessons learnt from past earthquakes.

**Unit-5:** Design Methodology - Causes of damage – Planning considerations / Architectural concepts – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Later load analysis – Design and detailing .

## **Text book**

1. 1. Agarwal. P and Shrikhande. M., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2007
2. IS 1893-1 (2002): Criteria for Earthquake Resistant Design of Structures

3. IS 4326 (1993): Code of practice for earthquake resistant design and construction of buildings
4. IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismic forces

### **References**

1. Chopra, A.K., “Dynamics of Structures – Theory and Applications to Earthquake Engineering”, 4<sup>th</sup> Edition, Pearson Education, 2011.

## **CE505 ADVANCE COMPOSITE STRUCTURES**

**Unit-1:** Introduction to composite materials – Types of FRPs - manufacturing and processing - basic material behaviour – mechanics

**Unit-2:** Analysis and design of flexural member using FRP materials – definition of under and over reinforced sections - stresses in FRP bars – deflection of FRP reinforced beams

**Unit-3:** Analysis and design of FRP strengthened columns – Compressive strength of FRP materials – strengthening of RC columns using FRP materials

**Unit-4:** Flexural and Shear strengthening of RC beams using FRP materials – Analysis and design

**Unit-5:** Seismic applications of FRP materials in RC structures – Analysis and design of RC members – Seismic Retrofitting of RC members.

### **Text Book**

1. SB Singh, FRP reinforced concrete structures, Tata Mc Graw Hill – 2014.

### **References**

1. American Concrete Institute 440 – Committee Guidelines, 2012.

## **CE507 REINFORCED EARTH AND GEOTEXTILES**

**Unit-1:** Reinforced Earth – The mechanisms of the reinforced earth techniques – Design principles – Materials used for construction – Advantages of reinforced earth – Reinforced earth construction techniques

**Unit-2:** An overview of Geosynthetics, Description of Geotextiles – Geogrids – Geonets – Geomembranes – Geocomposites – Geocells – Designing with Geotextiles – Geotextile properties and test methods – Functions of Geotextile – Design methods for separation – stabilization – filtration – Drainage

**Unit-3:** Designing with Geogrids – Geogrid properties and test methods – Designing with Geonets – Geonet properties and test methods – Designing with Geomembranes – Geomembrane properties and test methods – construction practices with Geotextiles, Geogrids, Geonets, Geomembranes

**Unit-4:** Design of liquid Contaminant liners – liquid contaminant liners – Covers for reservoirs- Water conveyance (Canal liners) - solid material liners – underground storage tanks

**Unit-5:** Design of pavements – Geo composites as liquid / Vapour Barriers – Improvement in bearing capacity – Erosion Control for water ways.

### References

1. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall ,1989 .
2. Rao, G. V., and Suryanarayana Raju, G. V. S., Engineering with Geosynthetics, Tata Mc Graw Hill Publishing Co. New Delhi, 1990.
3. Shukla, S. K., Geosynthetics and their Applications, Thomas Telford, London, 2002.

## CE509 EARTHQUAKE GEOTECHNICAL ENGINEERING

**Unit-1:** Mechanism of Earthquakes - Causes of earthquake - Earthquake Fault sources - Elastic Rebound theory - Seismic wave in Earthquake shaking - terminology - Locating an earthquake - Quantification of earthquakes.

**Unit-2:** Strong Motion Records - characteristics of ground motion - Factors influencing Ground motion - Estimation of frequency content parameters Seismic site investigations – Selected Case Studies –

**Unit-3:** Evaluation of Dynamic soil properties – Codal Provision Design Ground Motion - Developing Design Ground Motion-Codal recommendations. Earthquake Resistant Design of foundation of buildings - Design considerations

**Unit-4:** Earthquake Response of slopes - Evaluation of slope stability - Liquefaction-Susceptibility - Liquefaction Resistance

**Unit-5:** Codal recommendations. Risk mapping - Hazard assessment – Mitigation measures - Seismic microzonation and its importance

### References

1. Kameswara Rao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing - New Delhi, 2000.
2. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International Series, Pearson Education (Singapore) Pvt. Ltd., 2004.
3. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wheeler
4. Robert W. Day, Geotechnical Earthquake Engineering Hand book, McGraw Hill, 2002
5. Day R.W, Geotechnical Earthquake Engineering Hand Book, McGraw Hill handbook, New York, 2003.

## CE511 ADVANCED FOUNDATION ENGINEERING

**Unit-1:** Sheet pile structures - cantilever sheet pile walls in granular and cohesive soils - Anchored bulk heads - Free earth support and fixed earth support methods - Anchors.

**Unit-2:** Cofferdams - types - cellular cofferdam - uses - Design by TVA and Cumming's method. Well foundations - Types of caissons - Analysis of well foundations - determination of scour depth - steining thickness - well sinking.

**Unit-3:** Foundations subjected to vibrations - elements of vibrations - Free, damped, free and forced vibrations - Design criteria - Pauw's analogy - IS Code of practice for impact and reciprocating machines.

**Unit-4:** Foundation drainage and water proofing - Dewatering well points system, sand drains. Foundations in expansive soils - Mechanism - factors influencing swelling - Use of Geosynthetics.

**Unit -5:** Stability analysis of slopes - infinite slopes in sand and clays - finite slope - Swedish circle - stability of earth dam slope during steady and sudden draw down - friction circle method - Taylor's stability number.

## References

1. Bowles, J.E., Foundation Analysis and Design, McGraw Hill., 1996.
2. Braja M. Das, Principles of Foundation Engineering, Thomas Asia Pvt. Ltd., Singapore, 2005.
3. Shamsher Prakash, Soil Dynamics, McGraw - Hill Book Company, 1985.

## CE513 ENVIRONMENTAL IMPACT ANALYSIS

**Unit-1:** Environmental and its interaction with human activities- Strengths and limitations of EIA

**Unit-2:** Environmental Imbalances - Concept of Environmental Impact Assessment (EIA) - elements of the EIA process

**Unit-3:** EIA administration and practise - Qualitative Analysis of Environmental Impact-methods-types- stages that follow EIA

**Unit-4:** Environmental Indicators - Environmental issues of developmental projects – case studies-Role of public participation

**Unit-5:** The costs and benefits of undertaking EIA - Quantification of Impacts of development-case studies

## References:

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002
3. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.

## CE515 ENVIRONMENTAL POLLUTION CONTROL ENGINEERING

**Unit-1:** Environmental pollution - interrelationship between various forms of pollution - surface water pollution surveys - integrated river basin water management - restoration of water bodies - water quality changes by domestic use - radioactive materials - thermal

pollution and underground disposal - types of water pollutants and their effects - instrumentation for water quality and treatment.

**Unit-2:** Air pollution control strategy – air pollution control technology – methodological factors affecting air pollution – air pollution surveys – instrumentation for air quality measurement – air quality standards.

**Unit-3:** Land pollution – land pollution surveys - ecological aspects of vegetation control

**Unit-4:** Noise pollution - effects of noise - sources – noise control techniques - instruments for noise measurement - Light and glare pollution – outside lighting and glare sources - corrective procedures.

**Unit-5:** Water pollution laws and regulations - Air pollution control Act of India - Land pollution laws and regulations - The Environment (Protection) Act, 1986.

## References

1. Rao, C. S., Environmental Pollution Control Engineering, New Age International (P) Ltd., 2006.
2. Goel, P. K., Water Pollution Causes, Effects and Control, New Age International (P) Ltd., 2009.
3. Birdie, G. S. and Birdie, J. S., Water Supply and Sanitary Engineering, Dhanapat Rai and Sons, 2007.
4. Liptak Bela G., Environmental Engineers Hand Book Vols. I, II and III

## CE517 ENVIRONMENTAL RISK ASSESSMENT

**Unit-1:** Introduction Basic concepts of environmental risk assessment and definitions, risk assessment as an environment management tool, use of risk assessment and management techniques in policy and regulatory decisions, use of risk assessment and management techniques in industry, typology of risk assessment and management techniques, over view of risk assessment methods - NAS model- hazard identification, dose-response assessment, exposure assessment, risk characterization.

**Unit-2:** Human health risk assessment Physical risks- ionizing radiation- hazard identification, dose-response assessment, exposure assessment, risk characterization. Chemical risks- hazard identification, dose-response assessment, exposure assessment, risk characterization, deterministic vs. probabilistic risk assessment, neurotoxic risk assessment, immunotoxic risk assessment, developmental toxicity risk assessment, reproductive toxicity risk assessment, risk assessment of endocrine disruptors, carcinogenic risk assessment. Biological Risks- hazard identification, hazard characterization, exposure assessment, risk characterization, risk assessment of genetically modified organisms.

**Unit-3:** Ecological risk assessment Risk assessment process for chemicals- hazard identification, effects assessment, exposure assessment, risk characterization. Risk assessment of plant protection products. Risk assessment of genetically modified organisms.

**Unit-4:** Application of environmental risk assessment in industry Site specific ERA for non-routine releases- hazard identification/ release assessment(methods like Hazop, What-if, knowledge based hazop, Fault tree analysis, Event tree analysis, Cause-consequence analysis, reliability block diagrams, task analysis, etc.), exposure assessment, consequence assessment, risk estimation. Site specific ERA for routine releases.

**Unit-5:** Transportation risk assessment, product risk assessment, risk minimization measures. Risk assessment techniques for specific industrial applications- off-shore installations, nuclear installations, contaminated land, waste management. Relation between ERA and Life cycle assessment (LCA).

## References

1. European Environmental Agency (EEA), Environmental Risk Assessment – Approaches, Experiences, and Information Sources.
2. Lerche, Ian and Walter Glaesser, Environmental Risk Assessment: Quantitative measures, anthropological influences, human impact, Springer Publishers, 2010.
3. Robson, Mark, William Toscano (Ed.), Risk Assessment for Environmental Health, John Wileyand Sons Inc, 2007.
4. Molak, V., Fundamentals of risk analysis and risk management, CRC Press, 1997.

## CE519 RAILWAY ENGINEERING

**Unit-1:** Indian railways: Development and organization of Indian Railways. Rails: Rail gauges, types of rails, defects in rails, rail failure, creep of rail. Rail Fastenings: Fish plates, spikes, chairs, keys, bearing plates. Sleepers: Timber, steel, cast iron, concrete and prestressed concrete sleepers, manufacturing of concrete sleepers, sleeper density. Ballast: Ballast materials, size of ballast, screening of ballast, specification of ballast, tests on ballast.

**Unit-2:** Railway Track Geometry: Gradients, horizontal curves, super-elevation, safe speed on curves, cant deficiency, negative super elevation, compensation for curvature on gradients, track resistance and tractive power.

**Unit-3:** Permanent way: Sub-grade, formation, embankment and cutting, track drainage. Track maintenance and rehabilitation - Railway accidents

**Unit-4:** Points & Crossings : Elements of a simple turn-out, details of switch, details of crossings, number & angle of crossings, design of turn-out. Rolling Stock - Railway sections and yards. Signalling - interlocking

**Unit-5:** Design of tracks for high speeds, modern tracks and technologies

## References

1. Chandra S. and M.M. Agarwal, Railway Engineering, Oxford University Press, New Delhi, India, 2007.
2. Saxena, S.C. and S.P. Arora, Railway Engineering, Dhanpat Rai and Sons, New Delhi, India, 1997.
3. Agarwal, M.M., Indian Railway Track,Prabha and Co., New Delhi, India, 1988.
4. Rangwala, S.C., Principles of Railway Engineering, Charotar Publishing House, Anand, India, 1988.

## CE521 TRANSPORTATION PLANNING

**Unit-1:** Urban Transportation Planning Process and Concepts: Role of transportation - Transportation problems - Urban travel characteristics - Evolution of transportation planning process

**Unit-2:** Concept of travel demand - Demand function - Independent variables – Travel attributes - Assumptions in demand estimation - Sequential, recursive and simultaneous processes

**Unit-3:** Trip Generation Analysis: Definition of study area - Zoning - Types and sources of data -Road side interviews - Home interview surveys - Expansion factors - Accuracy checks - Trip generation models - Zonal models -Category analysis - Household models - Trip attractions of work centres.

**Unit-4:** Trip Distribution Analysis: Trip distribution models - Growth factor models – Gravity models - Opportunity models.

**Unit-5:** Mode Split Analysis: Mode split analysis - Mode choice behaviour, Competing modes, Mode split curves, Probabilistic models. Route Split Analysis - Route split analysis: Elements of transportation networks, coding -minimum path trees, all-or-nothing assignment.

### References

1. Khisty, C. J., Transportation Engineering – An Introduction, Prentice Hall, 3<sup>rd</sup> Edition, 2002.
2. Papacostas, Fundamentals of Transportation Planning, Tata McGraw Hill, 3<sup>rd</sup> Edition, 2002.
3. Dicky, J. W., Metropolitan Transportation Planning, Tata McGraw Hill, 1983
4. Bruton, M. J., Introduction to Transportation Planning, Hutchinson of London, 1970.
5. Hutchinson, B. G., Principles of Urban Transportation System Planning, McGraw Hill
6. ITE (1982), 'Transportation and Traffic Engineering Hand Book', Chapters 10,12 , and 17, Prentice Hall, New Jersey
7. Kanafani, A., Transportation Demand Analysis, McGraw-Hill, 1983.
8. Konstadinos G. Goulias, Transportation Systems Planning: Methods and Applications, CRC Press, 2002
9. Meyer, M. D. and Miller, E. J., Urban Transportation Planning, McGraw-Hill International, 2001
10. Oppenheim, N., Applied Models in Urban and Regional Analysis, Prentice-Hall, NJ, 1995.
11. Ortuzar, J. D., and Willumsen, L. G., Modelling Transport, John Wiley and Sons Ltd, 2001.
12. Wilson, A. G, Urban and Regional Models in Geography and Planning, John Wiley and Sons, 1974.

## CE523 TRANSPORTATION INFRASTRUCTURE DESIGN

**Unit-1:** Design of Highways: Hierarchy of Highway System, Functions, Geometric Design Standards, Design Controls and Criteria – Vehicle, Driver and Traffic; Cross-Section Elements, Typical Sections, Design of the Alignment - Sight distance , Horizontal Alignment, Vertical Alignment, Integration, Optical Design, Landscaping and Safety Considerations, Evaluation and Design of existing geometrics.

**Unit-2:** Design of Intersections: Types of Intersections and Controls, Principles of Intersection Design; Design of At-Grade Intersections – Design Elements, Channelization, Design using Templates; Rotary and Roundabout – Design, Capacity; Signalised Intersections – Benefits and Drawbacks, Warrants, Design; Signal Coordination – Methods, Design; Grade separated intersections – Warrants, Types, Geometric Standards, Spacing and Space controls, Ramps and Gore area design, Parking Facilities.

**Unit-3:** Pedestrian and Bicycle Facilities: Characteristics of Pedestrians and Bicycles, Issues Shared by Pedestrians and Bicycles, Pedestrian Facility Design - Walkways, Sidewalks, and Public Spaces, Pedestrian Facility Capacity and LOS

**Unit-4:** Signs and Pavement Markings, Intersections, Midblock Crossings, Flyovers and Subways; Bicycle Facility Design - Shared Roadways, Bike Lanes, Parking and Storage

**Unit-5:** Terminal Planning and Design: Terminal Functions, Analysis of Terminals, Process Flow Charts of Passenger and Goods Terminals, Terminal Processing Time, Waiting Time, Capacity and Level Of Service Concept, Study of Typical Facilities of Highway, Transit, Airport and Waterway Terminals, Concept of Inland Port.

### References:

1. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna publishers, 1987.
2. IRC-SP41: Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas
3. Salter, R. J., Highway Traffic Analysis and Design, ELBS, 1996.
4. Edward K. Morlock, Introduction to Transportation Engineering and Planning, International Student Edition, McGraw-Hill Book Company, New York, 1992.
5. Joseph, De Chiara, Urban Planning and Design Criteria, Van Nostrand Reinhold, 1982.
6. Joseph De Chiara, Michael J. Crosbie, Mike Crosbie, Time-Saver Standards for Building Types, McGraw-Hill Professional, 2001.
7. Guide for the Planning, Design, and Operation of Pedestrian Facilities, AASHTO, 2004
8. Guide for the Development of Bicycle Facilities, AASHTO, 1999
9. Manual on Uniform Traffic Control Devices (MUTCD), 2009
10. Urban Intersection Design Guide, Texas Department of Transportation, 2005

## CE525 WATER RESOURCES SYSTEMS

**Unit-1:** Objectives of Water Resources Planning and Development, Nature of Water Resources Systems



**Unit-2:** Socio - Economic Characteristics, Economic Analysis of Water Resources Systems, Application of systems techniques to water resources

**Unit-3:** Water Allocations for Water Supply, Irrigation systems, Hydropower and Flood Control methods

**Unit-4:** Reservoir Operations, Planning of an Irrigation System and operation, Irrigation Scheduling

**Unit-5:** Water Quality Management.

### **References:**

1. Charles S. Revelle, E. Earl Whitlatch and Jeff R. Wright, Civil and Environmental Systems Engineering, Pearson Education Inc., New Jersey, 2004.
2. Loucks, D.P. and Eelco van Beek, Water Resources Systems Planning and Management - An introduction to methods, models and applications, Studies and Reports in Hydrology, UNESCO Publishing, 2005.
3. Vedula. S., and Mujumdar, P.P, Water Resources Systems-Modelling Techniques and Analysis, TataMcGraw Hill, 2005.

## **CE527 HYDRO POWER**

**Unit-1:** Sources of energy - Hydropower – Place of hydropower in a power system – Fundamentals of Water Power Engineering- Classification of hydropower plants. Water power estimates – Essentials of stream flow for water power studies. Pondage and storage – effect of pondage on plant capacity-Benefits from storage.

**Unit-2:** Basic Hydrology. Mass curve and flow duration curve. Effect of reservoirs on flood flow. Load curve and load factor. Utilisation factor. Capacity factor. Diversity factor. Firm Power and Secondary Power-Prediction of load.

**Unit-3:** Run of the river plants. Pumped storage plants. General arrangement of power house. Types of power house. Mini and micro hydel plants. Tidal Power Plants.

**Unit-4:** Intakes. Forebay. Gates. Penstocks, Canals and Tunnels. Joints. Anchor Blocks. Bends and Manifolds. Valves. Water Hammer. Surges and Surge Tanks

**Unit-5:** Turbines and Generators. Flood routing through reservoirs and channels. Dam breach analysis. Cost and value of water power.

### **References**

1. Creager and Justin, Hydroelectric Engineering Handbook, John Wiley and Sons, 1963.
2. Barrows, H. K., Water Power Engineering, Mc Graw Hill Inc, 1955.
3. Mosonyi, Water Power Development, Hungarian Academy of Sciences, 1965.
4. Guthrie Brown, Hydroelectric Engineering Practice, Blackie and Sons Ltd; London, 1984.

5. Dandekar and Sharma, Water Power Engineering, Vikas Publishing House (P) Ltd., 2002.
6. Nigam, P. S., Handbook of Hydro Engineering. Nem Chand and Sons, Roorkee, 1985.
7. Zheng Naibo et al, Mini Hydropower, John Wiley and Sons, 1997.
8. UNIDO, Small Hydropower Series, UN, 1985.
9. Smail Khennas and Andrew Barnett, Best Practices for Sustainable Development of Mini Hydropower in Developing Countries, World Bank/ESMAP.
10. CBIP Journals and Publications.
11. Journal of Water Power and Dam Construction.
12. Indian Journal of Power and River Valley Development.

## **CE529 COASTAL ENGINEERING**

**Unit-1:** Introduction: Coastal Engineering – Coastal Environment – Problems, Coastal water level fluctuations – Tides- surges and seiches. Waves: Linear wave theory - Irregular and regular waves –Short and long term wave analysis – wind generated waves- wave forecasting

**Unit-2:** Wave transformations- shoaling- refraction – reflection – diffraction – breaking. Causes of coastal erosion, Shore protection, Type of beaches, Methods of shore protection – structural and non-structural methods. Wave structure interaction – Forces on shore structures due to breaking, broken and nonbreaking waves.

**Unit-3:** Shores and shore processes, long term and short term changes, Cross shore and long shore currents – Sediment transport - Onshore offshore movement of sediment – long shore transport - mathematical modeling - factors affecting equilibrium of beaches- Coastal erosion and protection along the east coast.

**Unit-4:** Coastal zone management: Coastal resource planning and management, Management goals and purposes, Sustainable use of resources, Application of IT in coastal zone management.

**Unit-5:** Coastal ecosystems including mangroves, Activities in coastal areas and environmental problems, mudbanks, Legislation in India including the CRZ and CZMA notifications.

### **References**

1. Kamphuis, J. W., Introduction to Coastal Engineering and Management, World Scientific, 2010.
2. Sorenson, R. M., Basic Coastal Engineering, John Wiley and Sons, 2005.
3. Shore Protection Manual Vol. I and Vol. II, U.S. Army Coastal Engineering Research Center, 1984.
4. John R. Clark, Coastal Zone Management Handbook University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Florida 2440 East Commercial Boulevard, Ft. Lauderdale, Florida 33308, 1996.

5. Dean, R. G., and R.A. Dalrymple, Coastal Processes with Engineering Applications, Cambridge University Press, 2004.
6. Reeve, D., Andrew Chadwick, and Christopher Fleming, Coastal Engineering, Spon Press, 2004.
7. Coastal Engineering Manual, U. S. Army Corps of Engineers, 2006.

### **CE531 COMPUTER ORIENTED MINI PROJECT**

The course is specially designed aims at developing the skills for operating, maintaining and developing software in innovative research areas of the department. As a part of education, this project course follows a method of learning and, therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day-to-day productivity and punctuality of the student. A maximum of three students can pursue this project together under one guide.

Every student group has to plan a modelling / analysis work using software package / developing computer program according to their interest in any one of the civil engineering field. Further, they should define the title and study plan. They should work towards their objective of the study plan. At the end of the course, the student group should submit a report on experimental program and outcomes.

#### **Evaluation Procedure**

The method of evaluation will be as follows: I<sup>st</sup> Evaluation: 20 marks (Decided by conducting a review by the department faculties) II<sup>nd</sup> Evaluation of Project Report: 20 marks (Decided by conducting a review by the department faculties). Final Evaluation: 60 marks (Decided by conducting final review by the department faculties along with an external expert preferably from the industry).

### **CE533 HOUSING PLANNING AND MANAGEMENT**

**Unit-1:** Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

**Unit-2:** Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations

**Unit-3:** Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

**Unit-4:** New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

**Unit-5:** Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems)

## **REFERENCES**

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 1999.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.
3. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
4. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 1994.
5. National Housing Policy, 1994, Government of India.

## **CE535 MODERN CONSTRUCTION MATERIALS**

**Unit-1** High strength and High performance concrete-Fiber Reinforced concrete

**Unit-2** New Alloy steels-Aluminium and its products-Other alloys- galvalume

**Unit-3** Plastics-Reinforced polymers-FRP-Cellular cores

**Unit-4** Water proofing compounds-Non -weathering Materials-Flooring and Facade Materials-False Ceiling and False Flooring

**Unit-5** Smart and Intelligent Materials-Brief outline and uses

## **References**

1. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
2. Mamlouk, M.S. and Zaniewski, J.P. Materials for Civil and Construction Engineers. Prentice Hall Inc., 1999
3. Derucher, K.Korfiatis. G. and Ezeldin, S, Materials for Civil and Highway Engineers Prentice Hall Inc., 1999
4. Aitkens, High Performance Concrete, McGraw Hill, 1999

## **ELECTIVES OFFERED IN VIII<sup>TH</sup> SEMESTER**

### **CE534 FINITE ELEMENT ANALYSIS**

**Unit-1:** Differential equilibrium equations - strain displacement relation - linear constitutive relation - special cases - Principle of stationary potential energy - application to finite element methods - Some numerical techniques in finite element Analysis

**Unit-2:** Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements - Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector

**Unit-3:** Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

**Unit-4:** Assemblage of elements – Direct stiffness method. Special characteristics of stiffness matrix -Boundary condition & reaction - Gauss elimination and LDLT decomposition. Basic steps in finite element analysis.

**Unit-5:** Analysis of framed Structures: 2D – truss element - 2D - beam element. Analysis of plate bending displacement functions - plate bending Elements. Plane stress and plane strain analysis: Triangular elements - Rectangular elements

## References

1. Krishnamoorthy, C.S, Finite Element Analysis Theory & Programming, McGraw-Hill, 1995.
2. Desai C.S and Abel, J.F., Introduction to the finite element Method, Affiliated East west Press Pvt. Ltd. New Delhi 2000.
3. Rajasekarn S, Finite Element Analysis, S. Chand Publishers, 2006.

## CE536 PRESTRESSED CONCRETE STRUCTURES

**Unit-1:** Principles of prestressing - Materials of prestressing - Systems of prestressing - Loss of prestress -Deflection of Prestressed Concrete members.

**Unit-2:** Slabs - Pre-tensioned and Post-tensioned beams - Design for flexure, bond and shear - IS code provisions - Ultimate flexural and shear strength of prestressed concrete sections Analysis and Design of end anchorage zones using IS code method.

**Unit-3:** Composite beams - Analysis and design. Partial prestressing - non-prestressed reinforcements.

**Unit-4:** Analysis of Continuous beams - Cable layout - Linear transformation - Concordant cables.

**Unit-5:** Design of compression members and tension members. Circular prestressing - Water tanks - Pipes - Analysis and design - IS Codal provisions.

## References

1. Krisnaraju, Prestressed Concrete, Tata Mcgraw Hill Publishing Co Ltd
2. Lin. T.Y., Burns, N.H., Design of Prestressed Concrete Structures, John Wiley & Sons, 1982.
3. Raja Gopalan N. Prestressed Concrete, Narosa Publishing House, New Delhi, 2002.

## CE538 FUNDAMENTALS OF NANOSCIENCE

**Unit-1:** Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilm-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**Unit-2:** Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**Unit-3:** Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

**Unit-4:** Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

**Unit-5:** X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques. AFM, SPM, STM, SNOM, ESCA, SIMS - Nano indentation

## References

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000
3. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
4. Akhlesh Lakhtakia (Editor), “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

## CE540 ECOLOGICAL ENGINEERING

**UNIT-1:** Scope and applications of Ecological Engineering – Development and evolution of ecosystems – principles and concepts pertaining to species, populations and community

**UNIT-2:** Energy flow and nutrient cycling – Food chain and food webs – biological magnification, diversity and stability, immature and mature systems. Primary productivity – Biochemical cycling of nitrogen, phosphorous, sulphur and carbon dioxide; Habitat ecology - Terrestrial, fresh water, estuarine and marine habitats.

**Unit-3:** Bio monitoring and its role in evaluation of aquatic ecosystem; Rehabilitation of ecosystems through ecological principles – step cropping, bio-wind screens, Wetlands, ponds, Root Zone Treatment for wastewater, Reuse of treated wastewater through ecological systems.

**Unit-4:** Ecological effects of exploration, production, extraction, processing, manufacture & transport.

**Unit-5:** Case studies of integrated ecological engineering systems

## REFERENCES

1. Odum, E.P., “Fundamental of Ecology”, W.B.Sauders, 1990.
2. Kormondy, E.J., “Concepts of Ecology”, Prentice Hall, New Delhi, 1996
3. Mitch, J.W. and Jorgensen, S.E., Ecological Engineering – An Introduction to Ecotechnology, John Wiley and Sons, 1996.
4. Colinvaux, P., Ecology, John Wiley and Sons, 1996.
5. Etnier, C & Guterstam, B., “Ecological Engineering for Wastewater Treatment”, 2<sup>nd</sup> Edition, Lewis Publications, London, 1996.

## CE542 REMOTESENSING AND GIS

**Unit-1:** Remote Sensing – Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere – Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials – Spectral Signature and Spectral Signature curves for water, soil and Earth Surface.

**Unit-2:** Satellites - Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of Remote Sensing - Visual Interpretation of Satellite Images – Digital Image processing – Characteristics of different platforms: Landsat, SPOT, IRS series, IKONOS, QUICKBIRD – Radar, LIDAR, SAR, MODIS, AMSRE, Sonar remote sensing systems.

**Unit-3:** GIS - History of Development - Components of GIS – Hardware, Software and Organizational Context –Data – Spatial and Non-Spatial – Data Input Sources— DBMS – Data Output - Data models - Raster and Vector data structures – Data compression – Raster vs. vector comparison

**Unit-4:** Analysis using Raster and Vector data – Operations – Overlaying - Buffering – Modelling in GIS - Digital Terrain Modelling, Analysis and application – Products of DEMs and their uses – Sources of errors in GIS and their elimination

**Unit-5:** Applications of Remote Sensing and GIS – Advanced applications of GIS – Disaster management, Water resource, Land use – Land cover – Urban planning - Intelligent Transport Systems - Development of Resources Information Systems.

### References

1. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication, 2004.
2. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice- Hall India, 2006.
3. Thomas. M. Lillesand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.

## CE544 CONCRETE TECHNOLOGY

**Unit-1:** Introduction - Concrete materials - Cement: Physical tests on cement - Concrete materials - Tests on aggregates - Quality of Water for mixing and curing - use of sea water for mixing concrete

**Unit-2:** Mix Design - factors influencing mix proportion - Mix design by ACI method and I.S. code method -Design of high strength concrete - Batching - Mixing -Transportation - Placing of concrete - curing of Concrete

**Unit-3:** Admixtures - accelerating admixtures - Retarding admixtures - water reducing admixtures - Air entraining admixtures - coloring agent - Plasticizers.

**Unit-4:** Strength of Concrete - Shrinkage and temperature effects - creep of concrete - permeability of concrete - durability of concrete - Corrosion - Causes and effects - remedial measures- Thermal properties of concrete - Micro cracking of concrete.

**Unit-5:** Special Concrete - lightweight concrete - Fibre reinforced concrete - polymer modified concrete - Ferrocement - Mass concrete - Ready mix concrete- Self compacting concrete- Quality control - Sampling and testing-Acceptance criteria

## References

1. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co, 2004.
2. Gambhir, M.L., Concrete Technology, Tata McGraw Hill, 2004.
3. Neville, Properties of Concrete, Longman Publishers, 2004.
4. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007.

## CE546 CONTRACT LAWS AND REGULATIONS

**Unit-I:** Construction Contracts- Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

**Unit-II:** Tenders - Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Transparency in Tenders Act.

**Unit-III:** Arbitration - Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs

**Unit-IV:** Legal Requirements - Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations

**Unit-V:** Labour Regulations - Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration– Insurance and Safety Regulations – Workmen’s Compensation Act – Indian Factory Act – Tamil Nadu Factory Act – Child Labour Act - Other Labour Laws

## References

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982
2. C PWD Hand book.
3. Jimmie Hinze, Construction Contracts, Second Edition, McGraw Hill, 2001
4. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, Sixth Edition, McGraw Hill, 2000.



## CE548 GROUND WATER HYDROLOGY

**Unit-1:** Groundwater occurrence – distribution – aquifer – types - Surface investigation - Geophysical -electrical resistivity - Seismic refraction - Gravity and magnetic - Geologic - Air photo interpretation - Dowsing.

**Unit-2:** Subsurface investigation - test drilling - resistivity logging- potential logging - temperature and caliper logging- Steady unidirectional flow - well in a uniform flow - steady flow with uniform recharge - unsteady radial flow to a well - well flow near aquifer boundaries - Multiple well systems - partially penetrating wells - characteristic well losses.

**Unit-3:** Secular and seasonal variations - Fluctuations due to evapo-transpiration, Meteorological phenomena, tides, external loads and earthquakes - control by drains and wells - Recharge through sewage pits, shafts and wells

**Unit-4:** Occurrence of sea water intrusion - Ghypon- Heizberg relation between fresh and saline waters - shape length and structure of the fresh salt water interface - prevention and control of seawater intrusion - role of sea water in ground water - coastal zoning.

**Unit-5:** Sand models - Electrical models - Viscous fluid models - membrane models - numerical analysis methods

### References

1. Raghunath H.M., Ground Water Hydrology, New-Age International, 2<sup>nd</sup> Edition, 1990.

## CE550 CONSTRUCTION MANAGEMENT

**Unit-I:** Construction Planning: Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Definition-Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

**Unit-II:** Scheduling Procedures And Techniques Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedence -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost trade offs -Improving the Scheduling process – Introduction to application software.

**Unit-III:** Cost Control Monitoring and Accounting - The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

**Unit-IV:** Quality Control and Safety During Construction Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

**Unit-V:** Organization and Use of Project Information Types of project information-Accuracy and Use of Information-Computerized organization and use of Information - Organizing

information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

### **Text-Book**

1. Chitkara, K.K. “Construction Project Management Planning”, Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.

### **References**

1. Srinath,L.S., “Pert and CPM Priniples and Applications “, Affiliated East West Press, 2001
2. Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamentals Concepts for Owners”, Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.

## **GLOBAL ELECTIVES OFFERED BY DEPARTMENT OF CIVIL ENGINEERING**

### **CE1001 ARCHITECTURAL HERITAGE OF INDIA**

**Unit-1:** Indus valley civilisation-Chronological introduction-Construction style - Materials used-The cities Harappa, lothal and Mohenjodaro, The great bath-The granary at Harappa-The assembly hall- Ajanta-Ellora Cave temples- Mahabodhi temple complex

**Unit-2:** Chera-Chola-Pandya architecture- Chronological introduction- construction style - materials used- Brihadeeswarar Temple-Meenakshi Temple - Kalinga-Chalukya –Pallava-architecture-Mahabalipuram stone temples- Khajuraho-Muskin Bhanvi- Konark Sun Temple- Hoysala-Vijayanagara architecture-twin temples Mosale-Virupaksha temple Raya Gopura at Hampi

**Unit-3:** Mughal architecture- Chronological introduction - Construction style- Materials used- Qutub Minar-Taj Mahal- Humayun’s Tomb-Redfort-Fatehpur Sikri-Agra fort-Jama Masjid-Rajput civil architecture- Chronological introduction - Construction style- Materials used-All hill forts of Rajasthan

**Unit-4:** British colonial architecture-Chronological introduction-Construction style - Materials used-Buildings in Chennai, Mumbai, Shimla-Churches-Mountain railways of India-bridges.

**Unit-5:** Other colonial architecture- Portugese-Dutch-French-Danish- Chronological introduction-Construction style - Materials used-Churches- Churches and Convents of Goa and Cochi-French town of Puducherry-Tranquebar fort – Bungalow on the beach

### **References:**

- 1) Introduction to Indian architecture, Bindia Thapar, Suparna Bhalla, Surat Kumar Manto, Periplus Asian Architecture Series, 2004.

## CE1002 GLOBAL WARMING AND CLIMATE CHANGE

**Unit-1:** Global warming-Causes of global warming-Greenhouse gases-Deforestation and global climate phenomena

**Unit-2:** Carbon dioxide and climate change-Methane and climate change-Nitrous oxide and climate change-Chlorofluorocarbons and climate change

**Unit-3:** Ozone layer, depletion and consequences-Methyl bromide and ozone depletion-El Nino and global climate change pattern

**Unit-4:** Zero waste, recycling the waste products and effects in climate change-Consequences of global warming

**Unit-5:** Convention on climate change-Kyoto protocol- Montreal protocol-Paris agreement

### References:

- 1) Global Warming and Climate Change: Past, Present & Future, S.K. Agarwal, A P H Publishing Corporation, 2013.

## CE1003 BASIC MECHANICS OF SOLIDS, FLUIDS AND FLUID MACHINERY

**Unit I:** Stress – Strain – Elastic constants – Stress in Composite bars – Beams – Types – Shear force and bending moment diagrams for simply supported and overhanging

**Unit II:** Columns - Long column – Euler’s Theory – Short column – Empirical formulae – Torsion of Circular shafts – Hollow Shafts – Power transmission.

**Unit III:** Vapour Pressure – Pressure at a point its variation – Measurement with Piezometer, manometers and gauges.

**Unit IV:** Continuity equation in one dimension – Bernoulli’s equation – Venturimeters and Orificie meters – Flow through pipes – Laminar, Turbulent flow - Major losses.

**Unit V:** Pumps – General principles of displacement and Centrifugal pumps – Efficiency and Performance Curves of Pumps – Cavitations in Pumps – Turbines – Efficiency – Governing of turbines.

### References

1. Ramamirtham, S., “Strength of Materials”, Dhanpat Rai and Sons, New Delhi, 2011.
2. Rajput , R.K., “Strength of Materials” , S.Chand and Co Ltd., New Delhi, 4th Edition, 2007.
3. Nagarathnam.S, “Fluid Mechanics”, Khanna Publishers, New Delhi, 1989.