Department of Civil Engineering
Andhra University College of Engineering(Autonomous)
Visakhapatnam-530 003
Andhra Pradesh, India
### I/IVB.E/B.TECH (FOUR YEAR COURSE) - SEMESTER SYSTEM
(With effect from 2006-2007 admitted batch onwards)

#### I & II SEMESTERS

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### B. E. II / IV (CIVIL & CIVIL ENVIRONMENTAL ENGINEERING)

#### SCHEME OF INSTRUCTION

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### ELECTIVE – I (COURSE NO. CE316)

- CE316 A Estimating and Quantity surveying
- CE316 B Repair and Rehabilitation of structures
- CE316 C Disaster Management

### FREE ELECTIVE – I.

### ELECTIVE – II (COURSE NO. CE326)

- CE326 A Environmental Impact Analysis.
- CE326 B Structural Dynamics
- CE326 C River Engineering
- CE326 D Remote Sensing and Geographical Information Systems (G.I.S.)
- CE326 E Environmental Impact assessment and Management of Water Resources Projects
- CE326 F Optimization Techniques
## B. E. IV / IV (CIVIL ENGINEERING) SCHEME OF INSTRUCTIONS

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|   |   |   |   | Elective – III (COURSE NO. CE416) |
|---|---|---|---|
| CE416 A | Industrial Structures |
| CE416 B | Multistorey Structures |
| CE416 C | Elements of Solid Waste management |
| CE416 D | Soil Dynamics & Machine Foundation |
| CE416 E | Principles of Water Quality Management |
| CE416 F | Port and Harbour Engineering |

|   |   |   |   | Elective – IV (COURSE NO. CE423) |
|---|---|---|---|
| CE423 A | Advanced Concrete Structures |
| CE423 B | Prestressed Concrete |
| CE423 C | Air Pollution Control |
| CE423 D | Ground Improvement Techniques |
| CE423 E | Coastal Engineering |
| CE423 F | Hydraulic Structures |

CE 424* Irrigation Structures, Design and Drawing: The fifty marks allocated for the Subject shall be considered as Semester end examination marks conducted by internal examiner only.
### B. E. II / IV (CIVIL & CIVIL ENVIRONMENTAL ENGINEERING)

#### SCHEME OF INSTRUCTION

**1st Semester:**

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| Total       | 24 | 4 | 8 | 36 | 520 | 280 | 800 | 28     |
UNIT –I: VECTOR CALCULUS:
Differentiation of Vectors, Curves in Space, Velocity and acceleration, relative velocity and acceleration, scalar and vector point functions, vector operator \( \nabla \) applied to scalar point functions-gradient, \( \nabla \) applied to vector point functions, divergence and curl. physical interpretations of \( \nabla f \), \( \nabla \cdot F \) and \( \nabla \times F \), \( \nabla \) applied twice to point functions, \( \nabla \) applied to products of point functions; Irrotational and solenoidal fields
Integration of vectors, line integral, circulation, work done, surface integral-flux, Green’s theorem in the plane, Stoke’s theorem, volume integral, divergence theorem.
Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates.

UNIT –II: INTRODUCTION OF PARTIAL DIFFERENTIAL EQUATIONS:
Homogeneous linear equations with constant coefficients- rules for finding the complimentary function, rules for finding the particular integral (working procedure), non - homogeneous linear equations.

UNIT –III: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS:
Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat equation, two dimensional heat flow in steady state - solution of Laplace’s equation in Cartesian and polar co-ordinates (two dimensional).

UNIT –IV: INTEGRAL TRANSFORMS;
Properties of Fourier Transforms, Convolution Theorem for Fourier Transforms, Parseval’s Identity for Fourier Transforms, Fourier Transforms of the derivatives of a function, simple applications to boundary value problems.

TEXT BOOK:

REFERENCES:


TEXT / REFERENCES:

3. Engineering Mechanics by J.L. Meriam
4. Mechanics for Engineers Statics and Dynamics by F.B. Beer and E.R. Johnston
UNIT I: Duties / obligations Accountability of structural engineer for the design of a structure: a) economy b) safety: (i) strength consideration (ii) stiffness consideration. Need for assessment of strength of a material – analysis for strength requirement for design purposes – Review of IS code provisions.


UNIT III: (a) Stresses on oblique plane – Resultant stress – Principle stress and maximum shear stress and location of their planes. Mohr’s circle for various cases of stresses; (b) Theory of pure torsion for solid and hollow circular sections – torsional shear stress distribution, effect of combined torsion, bending and axial thrust – equivalent B.M and T.M. (c) Longitudinal and Hoop stresses in thin cylinders subjected to internal pressure. Wire wound thin cylinders.

UNIT IV: Deflections of Beams: (i) Cantilever (ii) simply supported and (iii) over hanging beams, using (a) double integration and (b) Macaulay’s method. Analysis for forces in members of a truss (having 9 members or less) by tension coefficient method only.

UNIT V: Graphic Statics a) Determination of Resultants of Systems of Coplanar Forces ; b) Locating Centroids of Sections of various Shapes ; c) S.F. & B.M. Diagrams for (i) Cantilever, (ii) Simple Supports, (iii) Over – hanging Beams; d) Determination of Forces in Members of Trusses ( having 9 members or less) by Maxwell Diagram

TEXT BOOKS:
(1) Elements of strength of materials by Timoshenko and Young.
(2) Introduction to mechanics of solids by Popov.
(3) Structural Analysis by Pundit & Gupta
(4) Strength of materials by Hyder.
(5) Elementary mechanics of solids by P.N. Singer and P.K. Jha.
(6) Strength of materials by Ramamrutham.
(7) Strength of materials by Vazirani and Ratwani.
UNIT I:
(A) BUILDING STONES AND BRICKS, CLAY PRODUCTS:
Cements: Natural and artificial cements, types of various artificial cements and their uses. Wet and dry process of manufacturing ordinary Portland cement (OPC). Chemical and Physical analysis of OPC, various field and Lab. Tests on OPC as per IS code. Storing of cement in the field and godowns.
Modern renovation materials: Cement bound, polymer cement bound and pure polymer bound materials, their properties & uses.
Acousting and Insulating Products: Acoustic tiles, pulp, plaster etc., assembled units, sprayed on acoustical materials and their requirements. Thermal insulation and its requirements, types of insulating materials etc.

UNIT II:
(A) WOOD, WOOD BASED PRODUCTS: GLASS AND ITS PRODUCTS
Wood: Various ways of tree classifications, cross section details of trees, various methods of timber classification including punched card system, their general properties, various types of defects in wood and timber, Methods of seasoning and their importance, felling and conversion, various Mechanical Properties of timber, Decay of timber, preservation methods, common Indian trees and their uses.
Wood based Products: Veneers, Plywood and its types, Manufacturing of Plywood, plywood grades as per IS code, Laminated wood, merits of plywood and laminated wood, Lamin Boards, Block Boards, Batten board, Hard board, Particle boards and Composite boards. Synthetic resins.
Glass and its Products: Raw materials for glass, properties of glass, manufactured glass, types of glass, their uses, glass blocks and solid glass bricks (i.e., commercial forms of glass)

(B) PAINTS, VARNISHES, ASBESTOS, ASPHALT, BITUMEN, TAR AND PLASTICS:
PAINTS AND VARNISHES: Constituents and characteristics of paints, types of paint, their uses and preparation on different surfaces, painting defects, causes and remedies. Constituents of varnishes, uses of varnishes, different kinds of varnish, polishes, Lacquer etc.
ASBESTOS & ASPHALT BITUMEN & TAR
Availability and uses of asbestos, properties of asbestos, various types of asbestos, difference between asphalt & bitumen, Types, uses and properties of Asphalt & Bitumen, composition of coal tar, wood tar, mineral tar and Naphtha.

UNIT III:


UNIT IV:
(A) MORTAR JOINTS: Plastering – Pointing – Other Wall Surface Finishes – Pebble dash – dadooing with stones, Tiles etc.
Floorings : Brief description with dimensions of different types – Ellis pattern, Granolithic, Flag stone floorings with locally available stones such as Cuddapah, Betamcherla, Shabad etc., Marble Flooring, Terrazo (Mosaic) Flooring, Rubber Flooring.
(B) CONCRETE TECHNOLOGY AND MIX DESIGN,
Cement and Polymer Concrete: Types of cement concrete, ingredients and their characteristics, Cement concrete properties and relevant tests, storage, batching, mixing & transporting, placing & vibrating and curing. Concrete grades & mix designs up to M 20 as per IS code. Introduction to polymer concrete and its uses.

UNIT V:
(A) Roofing: Mangalore tiled Roof, RCC roof, Madras Terrace, Hollow Tiled Roof, Asbestos Cement, Fibre glass, Aluminium G.I. Sheet roofings.
Trusses: King Post & Queen Post Trusses – Steel roof Truss for 12m Span with details.

(B) Painting of interior walls, exterior walls, wooden doors and windows – steel windows – various types of paints (chemistry of paints not included) including distempers; emulsion paints etc., Varnishes wood work finishing types.

(C) Wooden Doors and Windows – Parallel – Glazed – Flush shutters, Plywood, Particle Board Shutters – Aluminium, PVC, Steel doors, windows and ventilators, various types of windows, Glazing – different varieties.
Stair cases or Stairway design (Architectural design or planning only) various types such as, straight flight – dog legged, quarter landing, open spiral, spiral stairs etc.

REFERENCE BOOKS SUGGESTED:


(b) Traverse Surveying: Chain and compass traversing-Free or loose needle method – Fast needle method-Checks in closed and open traverse-Plotting methods of traverse Survey - Closing error-Balancing the traverse-Bowditch’s method-Transist method, Gale’s Travers table.


UNIT V: Minor instruments: Uses and adjustments of the following minor instruments:
Line Ranger, Optical Square, Abney level, Clinometer, Ceylon Ghattracer, Pantagraph, Sextant and Planimeter.


TEXTBOOKS:
2. Surveying Vol.1, 2 and 3 – By Punmia, Standard Book House.
Unit-I: General Geology:

Unit – 2: Petrology & Mineralogy
Mineralogy: physical properties: form, color, luster, cleavage, fracture, hardness and specific gravity. Study of important rock forming minerals: Silicate sturcutres, Quartz, feldspars, pyroxenes, amphiboles, micas and clays.

Unit – 3: Statigraphy & Structural geology

Unit – 4: Remote sensing and Geophysical methods

Unit – 5: Geological applications to Civil Engineering Structures.

Text books:
2. Engineering Geology by N.Chennakesavulu, Mc-Millan, India Ltd. 2005
4. Engineering and general geology by Parbin Singh – Katson Publishing house
6. Engineering Geology by K.M.Bangaru
CE217  STRENGTH OF MATERIALS LABORATORY

University Examination: Duration 3 hrs. Marks:50
Sessional Marks: 50

No of Periods per Week: 0 L+ 3P

(1) Tension test on Mild/HYSD bars
(2) Compression test on wood (parallel and perpendicular to grains)
(3) Tests on springs for the determination of rigidity modulus and spring constant
(4) Brinell’s and Rockwell hardness tests.
(5) Charpy and Izod impact tests.
(6) Double shear test on mild steel specimen.
(7) Bending test.: Load deflection test for the determination of young’s modulus on simply supported and cantilever beam for wood and steel.
(8) Study of forces in coplanar force system.
1. Chain Surveying
   b. Chain traversing –Preparation of plan of a residential building by making use of chain, ranging rods, by oblique off-set method, introduction of check line.
   c. Preparation of residential building by perpendicular offset, introduction of tie lines.
   d. Finding the distance between inaccessible points by making use of chain, cross staff, tape, ranging rods; Arrows and field problems of obstacles to chaining.

2. Compass Survey.
   a. Introduction to prismatic compass-Temporary adjustments.
   b. Finding the distance between inaccessible points by making use of compass, tape and ranging rods.
   c. Compass traversing-plotting of a residential building.

3. Plane Table Survey.
   a. Introduction to plane table-Use of its accessories: Two & Three Point Problem.
   b. Finding the distance between inaccessible points by making use of plane table, its accessories-Ranging rods and tape.

4. Levelling.
   a. Introduction to dumpy level, levelling staff. Reading of level staff, temporary adjustments of dumpy level.
   b. Introduction to fly levelling-Booking the readings by height of collimation method.
   c. Introduction to fly levelling-Booking the readings by rise and fall method-To find closing error.
   d. Check levelling- L.S. & C.S. of a road profile.
   e. Preparation of contour plan for an open area by taking level of the site.

Field work examination, for sessional marks.
### 2nd Semester:

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**Total:** 25 5 9 39 520 380 900 28
I. FUNCTIONS OF A COMPLEX VARIABLE:
Continuity concept of \( f(z) \), Derivative of \( f(z) \), Cauchy-Riemann Equations, Analytic functions, Harmonic Functions, Orthogonal systems, Applications to flow problems, Integration of complex functions - Cauchy’s theorem, Cauchy’s integral formula, Taylor’s and Laurent’s series without proofs, singular points, Residues and Calculations of residues, Cauchy’s Residue Theorem, Evaluation of real definite integrals (integration around Unit circle, semi circle, rectangular Contour and countours having poles on real axes).
Geometric representation of \( f(z) \), conformal transformation, some standard transformations: (1)\( w = z+c \), (2) \( w = 1/z \), (3) \( w = cz \), (4) Bilinear transformation.
Special Standard transformations (iv) \( w = z^2 \) and \( w = e^z \).

II. STATISTICAL METHODS:
Random variable, Discrete probability distribution, expectation, repeated trails, Binomial distribution, Poisson distribution, Continuous probability distributions – Normal distribution.

Sampling Theory:
Sampling distribution, standard error, Testing of hypothesis, Level of significance, Confidence limits, Simple sampling of attributes, sampling of variables-large samples, and small samples, Student’s \( t \)-distribution, \( \chi^2 \)-distribution, F-distribution, Fisher’s \( Z \)-distribution.

III. DIFFERENCE EQUATIONS AND Z-TRANSFORMS:
Finite difference equations – definition, order and solution of difference equations, formation of difference equations, linear difference equations, rules for finding complementary function, rules for finding particular integral, simultaneous difference equations with constant coefficients.
Z-transforms- definition, some standard Z-transforms, Linear property, Damping rule, some standard results, shifting rules, initial and final value theorems, Convolution theorem, Evaluation of inverse transforms, applications of Z-transform to difference equations.

TEXT BOOK:

REFERENCES:
UNIT I: Strain – energy due to (i) Axial load, (ii) Shear force, (iii) Bending Moment and (iv) Torque; Deflections of statically determinate structures:
   (a) Beams using
      (i) Moment area method,
      (ii) Conjugate beam method,
      (iii) Unit load method,
      (iv) Conservation of energy method and
      (v) Castigliano’s theorem – 1.
   (b) Single storey, single bay rectangular portal frames using
      (i) Unit load method,
      (ii) Castigliano’s theorem – 1.
   (c) Trusses (having 9 members or less) using
      (i) Unit load method,
      (ii) Castigliano’s theorem-1.
      (iii) Williat Mohr Diagram.

UNIT II: Shear force and bending moment diagrams for (a) fixed beams, (b) three span continuous beams using
(i) Theorem of three moments, (ii) Slope deflection method and (iii) Moment distribution method.


UNIT IV: Open and closed coiled helical springs subjected to axial load. Thick cylinders – lamme’s theory, Compound tubes – Theory of failure (a) Principal Stress theory, (b) Principal Strain theory, (c) Maximum Shear Stress theory and (d) Maximum strain energy theory.

UNIT V: Moving loads: Maximum Shear force and bending moment diagrams for different types of loads. Maximum Bending moment at a section under a wheel load and absolute maximum Bending moment in the case of several wheel loads. Equivalent uniformly distributed live load for Shear force and bending moment. Reversal of nature of Shear force, focal length, counter bracing for truss panels, Influence lines for (i) Beams and (ii) members of Warren and Pratt trusses.

REFERENCES:
(1) Structural Analysis by Pundit & Gupta.
(2) Strength of Materials – Ramamrutham.
(3) Elementary strength of materials – Timoshenko and Young.
(4) Strength of materials – Singer.
(5) Strength of materials – Jain and Arya.
(6) Analysis and Design of structures – Vazirani and Ratwani
# CE223 Fluid Mechanics - I

**University Examination:** Duration 3 hrs. Marks: 70  
No of Sessional Marks: 30

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## UNIT I: Fluid Properties and Fluid Statics.

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<th>Topic</th>
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<tr>
<td>(1) Introduction &amp; Physical Properties of Fluids.</td>
<td>Definition of Fluid, Fluid as Continuum; Mass Density, Specific Weight, Specific Gravity, Specific Volume, Relative Density, Bulk Modulus, Compressibility, Vapour Pressure.</td>
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<tr>
<td>(4) Forces on Immersed Bodies in Static Fluids.</td>
<td>Force on a Plane Surface- Centre of Pressure, Pressure Diagram, Forces on Curved Bodies, Forces on radial Crest Gates and Lock Gates.</td>
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<td>(6) Liquids in Relative Motion.</td>
<td>Pressure of Liquids in a Container Subjected to Linear Acceleration and Rotation.</td>
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## UNIT II: Fluid Kinematics.

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<th>Topic</th>
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<tr>
<td>(8) Fluid Kinematics.</td>
<td>Translation, Deformation and Rotation of a Fluid Element in Motion; Translation, Deformation of a Fluid Element; Local, Convective and Total Acceleration; One, Two &amp; Three Dimensional Analysis of Flows.</td>
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<tr>
<th>Topic</th>
<th>Description</th>
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<tr>
<td>(13) Flow through Tanks and Reservoirs</td>
<td>Measurement of Discharge from Tanks and Reservoirs- Steady and Unsteady Flow through Orifices and Mouthpieces-Small &amp;Large Orifices Different types of Mouthpieces- Cδ, C, Cc, Discharge from tanks through Drowned Orifices, Time of Emptying Tanks, Discharge from a Tank with Inflow, Kinematics of Free Jet- Vortex Motion and Radial Flow.</td>
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<td>UNIT IV: Fluid Dynamics – Momentum Principle.</td>
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<td><strong>(15) Principle of Conservation of Momentum.</strong></td>
<td>Momentum of Fluids in Motion - Impulse Momentum Equation- Momentum Correction Factor.</td>
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<td><strong>(19) Angular Momentum for fluid flows</strong></td>
<td>Angular Momentum Equation- Torque and Work done by series of Moving Vanes; Sprinkler Problems.</td>
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<tr>
<th>UNIT V: Steady Flow through Pipes.</th>
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**Text Books**
1. Engineering Fluid Mechanics by K.L. Kumar, S. Chand & Co
2. Fluid Mechanics by A.K. Jain, Khanna Publishers

UNIT II: Theodolite traversing – Open and closed traverse – Closing errors, Balancing the error – Bowditch method – Transit method, Omitted measurements – Gales traverse table or Trigonometric levelling – Elevation of top of the tower - same plane - Different planes – Axis signal correction.


UNIT V: Introduction to geodetic surveying, Total station and global positioning system- Introduction to Geographic Information System (GIS)

2. Surveying Vol.1, 2 and 3 – By Punmia, Standard Book House.
UNIT I:
Residential Buildings: Different types of Residential Buildings Selection of Site for Residential Building. Brief Information of Housing Colonies for Different Income Groups in India - Sizes of Plots - Public Spaces, Evolutionary Housing Concept.

UNIT II:

UNIT III:
Preliminary Drawings: (a) Conventional signs of materials various equipment used in a Residential Building (copying exercise) (b) Plan section and Elevation of a small House (one room and varandah) (copying exercise) (c) Plan section and Elevation of Two Bed Room House (copying exercise) (d) (e) (f) Plan section and Elevation of three bed room house in Hot and Humid zone, Hot and Arid zone, Cold zone (copying exercises)

UNIT IV:
(a) Design of Individual rooms with particular attention to functional and furniture requirements. Building regulations and Byelaws of Residential Buildings;
(b) Drawing the Plan Section and Elevation of flats (Not included in the examination).

UNIT V: Drawing the Plan Section and Elevation of Houses with given Functional requirements and climatic data. (Emphasis may be given to Hot and Humid zones.)

Text Books
Module 1: Introduction.
- Definition, scope and importance.
- Measuring and defining environmental development; indicators. (1 Lecture)

Module 2: Ecosystems.
- Introduction, types, characteristic features, structure and functions of ecosystems.
  - Forest
  - Grass Land
  - Desert
  - Aquatic (Lake, rivers and estuaries) (2 Lectures)

Module 3: Environmental and Natural Resources Management.
- Land resources
- Land as resource
- Common property resources
- Land degradation
- Soil erosion and desertification
- Effects of modern agriculture, fertilizer –pesticide problems.
  - Forest resources.
    - Use and over-exploitation.
    - Mining and dams – their effects on forest and tribal people.
  - Water resources.
    - Use and over-utilization of surface and groundwater.
    - Floods, droughts.
    - Water logging and salinity.
    - Dams –benefits and costs.
    - Conflicts over Water
  - Energy resources.
    - Energy needs.
    - Renewable and non renewable energy sources.
    - Use of alternative energy sources.
    - Impact of energy use on environment (8 Lectures)

Module 4: Bio-diversity and its conservation.
- Value of bio-diversity  -consumptive and productive use, social, ethical, aesthetic and option values.
- Bio-geographical classification of India – India as a mega diversity habitat.
- Threats to bio-diversity –Hot-spots, habitat loss, poaching of wild life, loss of species, seeds, etc.
- Conservation of bio-diversity – Insitu and Ex-situ conservation. (3 Lectures)

Module 5: Environmental Pollution –Local and Global Issues.
- Causes, eeffects and control measures.
  - Air pollution.
  - Indoor air pollution.
  - Water pollution.
  - Soil pollution.
  - Marine pollution.
  - Noise pollution.
  - Solid waste management, composting, vermiculture.
  - Urban and industrial waseta, recycling and re-use.
- Nature of thermal pollution and nuclear hazards.
- Global warming.
- Acid rain.
- Ozone depletion. (8 Lectures)

Module 6: Environmental Problems in India.
- Drinking water, sanitation and public health.
- Effects of the activities on the quality of environment.
• Urbanization.
• Transportation.
• Industrialization.
• Green revolution.

➢ Water scarcity and groundwater depletion.
➢ Controversies on major dams – resettlement and rehabilitation of people: problems and concerns.
➢ Rain water harvesting, cloud seeding and watershed management. (5 Lectures)

Module 7: Economy and Environment.
➢ The economy and environment interaction.
➢ Economics of development, preservation and conservation.
➢ Sustainability: theory and practices.
➢ Limits to growth.
➢ Equitable use of resources for sustainable life styles.
➢ Environmental Impact Assessment. (4 Lectures)

Module 8: Special issues and Environment.
➢ Population growth and environment.
➢ Environmental education.
➢ Environmental movements.
➢ Environment vs Development. (2 Lectures)

Module 9: Institutions and Governance.
➢ Regulation by Government.
➢ Monitoring and enforcement of Environmental regulation.
➢ Environmental acts.
  ▪ Water (Prevention and control of pollution) act.
  ▪ Air (Prevention and control of pollution) act.
  ▪ Environmental Protection act.
  ▪ Wild life Protection act.
  ▪ Forest conservation act.
  ▪ Coastal zone regulations.
➢ Institutions and policies relating to India.
➢ Environmental Governance.

Module 10: International conventions.
➢ World Commission for Environmental Development (WCED) (2 Lectures)

Module 11: Case Studies.
➢ Chipko movement.
➢ Narmada Bachav Andolan.
➢ Silent Valley Project.
➢ Madhura Refinery and Taj Mahal.
➢ Industrialisation of Patancheru.
➢ Nuclear reactor at Nagarjuna Sagar.
➢ Tehri dam.
➢ Ralegaon Siddhi (Anna Hazare).
➢ Kolleru Lake – aquaculture.
➢ Florosis in Andhra Pradesh. (3 Lectures)

Module 12: Field work.
➢ Visit to a local area to document and mapping environmental assets – river / forest / grass land / hill / mountain.
➢ Study of local environment- common plants, insects, birds.
➢ Study of simple ecosystems – pond, river, hill, slopes etc.
➢ Visits to industries, water treatment plants, affluent treatment plants. (5 Lectures)
CE229 HUMAN VALUES & PROFESSIONAL ETHICS

No of Periods per Week: 2 L+ 0 T
Credits: 2
Sessional Marks: 100

UNIT-I  
Ethical Theories
• Basic Moral Theories:  
  i) Beneficence: doing good to others  
  ii) Non-violence or peace  
  iii) Justice

UNIT-II
• Classification of Ethical Theories:
  i) Consequentialism–Mill’s utilitarianism-
greatest happiness to greatest number of people.
  ii) Deontology-Kantianism-Actions must satisfy the
categorical imperative.
  iii) Virtue theory-Aristotelianism virtue is a mean
between two extremes of action or passion.

UNIT-III
• Rights & Responsibilities of a citizen:
  i) Fundamental duties as stipulated in the constitution
of India.
  ii) The rights to individuals guaranteed by Indian
constitution.
  iii) (a) Rights of a professional
      (b) Professional responsibilities.

UNIT-IV
• Human Values & Attitudes:
  i) Classification of Values
  ii) Analysis of desirable values
  iii) The importance of attitudes in personal &
Professional lives.

UNIT-V
• Ethical Living:
  i) Maslow’s theory of Hierarchy of needs.
  ii) Clayton Alderfer’s ERG (Existence, Relatedness and
Growth) theory.
  iii) Concept of harmony in life.

1. Measurement of Horizontal Angles by Repition and Reiteration methods.
2. Distance between two inaccessible points by making use of theodolite.
4. Tachometry.
5. Finding the gradients.
6. Setting out of curves by deflection angles method and by making use of two theodolites.
7. Exercises on use of G.P.S. & Total Station.
1. Calibration of Small orifice, by constant head method and Time of emptying a tank through a small orifice.
2. Calibration of Cylindrical mouthpiece by constant head method and Time of emptying a tank through a Cylindrical mouthpiece.
3. Calibration of Convergent mouthpiece by constant head method.
4. Calibration of Borda’s mouthpiece by constant head method.
5. Calibration of Venturi meter.
9. Calibration of V-notch and Trapezoidal notch
### SCHEME OF INSTRUCTION

#### 1st Semester:

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**Total: 28  6  8  42  590  410  1000  33**

#### ELECTIVE – I (COURSE NO. CE 316)

- CE316 A Estimating and Quantity surveying
- CE316 B Repair and Rehabilitation of structures
- CE316 C Disaster Management
General: Loading standards as per IS 875, Grades of steel and cement, Stress-Strain characteristics of concrete and steel, Limit State Method (L.S.D.) of design.


UNIT – II: Design of one way and two way slab: Simply supported slabs on all four sides, Moment in two way slabs with corners held down. Choosing slab thickness. Design of restrained slabs (with torsion at corners) I.S. code provisions. Detailing of reinforcement. Load from slabs on supporting beams. Different kinds of loads on slabs including partition walls, Shear in slabs.


UNIT – V: Working Stress Method – General Introduction, Fundamental Assumptions, Method of Transformed Sections, Stress-Strain relationship. – Rectangular Sections in Bending with Tension Reinforcement only – Under-reinforced, Idealyreinforced Balanced and Over-reinforced Sections – Design of Rectangular sections in Bending with Tension Reinforcement only and with both Tension& Compression reinforcement. – Non-rectangular sections in Bending (T and L sections)

TEXT BOOKS:
Limit State of Design of Reinforced Concrete – P, C. Vergheese
R.C.C Design – Unnikrishna Pillai and Vasudeva Menon.
REFERENCES:
Reinforced Concrete Limit state Design - P. Dayaratnam
- Purushothaman
-Park and Paulay - James G. Mac Gregor
Note: All the designs should be taught in the limit state design method as per IS 800-2007

UNIT – I: Fundamental Concepts of limit state design of structures, Different types of rolled steel sections available to be used in steel structures. Stress – Strain relationship for mild steel.
Bolted connections: Behavior of bolted joints, Desing strength of ordinary black bolts, high strength friction grip bolts, Pin connections, Simple connections, Moment resistant connections.

UNIT – II: Welded Connections :Advantages of welding,Types and properities of welds, Types of joints,wled specifications Design of welded joints subjected to axial load, Eccentric welded connections.

UNIT – III: (a)Tension members: Types of tension members, Design of strands, slenderness ratio, displacement of tension members, behavior of tension members, modes of failure, factors affecting strength of tension members, angles under tension, design of tension members, Lug angles, splices.
(b)Compression members: Possible failure modes, classification of cross-section, behavior of compression members, Effective length, radius of gyration and slenderness of compression members, Allowable stresses in compression, Design of axially loaded compression members, Built up compression members, Laced and Battened columns, eccentrically loaded columns, Column splices.

UNIT - IV:(a) Beams : Beam types, section classifications, lateral stability of beams, Allowable stress in bending, Shear and Bearing stresses, Effective length of compression flange, Laterally supported and unsupported beams, Design of built up beams..
(b) Roof trusses : Types of trusses, Economical spacing of roof trusses, loads on roof trusses, Estimation of wind load on roof trusses as per IS : 875. Design of members of roof truss and joints, Design of purlins.

(b) Introduction to pre-engineered structures, concepts and advantages, disadvantages.

REFERENCES:

Design of Steel structures – N. Subramanian, Oxford University Press.
Design of steel structures – Ramchandra (Vol. I & II)
## CE313 - Fluid Mechanics – II

No of Periods per Week: 4 L+ 1 T

<table>
<thead>
<tr>
<th>Unit I Viscous Effects on Fluid Motion.</th>
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<tbody>
<tr>
<td>(1) Laminar Flow and N.S. Equations.</td>
<td>Equation of Motion for Real Fluids- Modifications in Equation of Motion- Stress Strain Relationships - Tangential Stress Terms - Development of Navier-Stokes Equations - Solution of N.S. equations for standard cases of Plane two Dimensional and Axisymmetric Flows.</td>
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<tr>
<td>(2) Plane Two-dimensional Flows.</td>
<td>Steady Flow between Parallel Plates- Couette and Poiseuille Flows- Unsteady laminar Flow Past a Flat Plate,</td>
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<td>(4) Special Cases of Viscous Flow</td>
<td>a) Laminar Flow between Co-axial Cylinders, b) Hydrodynamic Lubrication and c) Low Reynolds Number Flow Around a Sphere.</td>
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<tr>
<th>Unit II Boundary Layer Theory</th>
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<th>Unit III Drag, Lift &amp; Propulsion.</th>
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<tr>
<td>(11) Concepts of Drag and Pressure Distribution over Immersed Bodies.</td>
<td>Drag and Lift- Deformation Drag, Friction Drag, Form Drag- Drag coefficient. Distribution of Fluid Pressure on immersed bodies – Pressure Distribution for flow past a circular disk, sphere- Effects of eddy pattern in two dimensional flow – Distribution of pressure for two dimensional flow past a cylinder - Von Karman vortex trail- Eddy shedding; Drag of immersed bodies - Variation of Drag Coefficient with Reynolds Number; Drag on Cylinder –Resistance diagram for bodies of revolution- Drag Coefficient of Practical Bodies.</td>
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<td><strong>Unit IV Open Channel Flows – I.</strong></td>
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<td><strong>(19) Canal Transitions &amp; Control Sections.</strong></td>
<td>Canal Transitions- Change of Depth in Channels with (a) Change in Cross-section and (b) Hump in the Bed- Control Sections- Venturi Flume and Parshall Flume.</td>
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<th><strong>Unit V Varied Flow in Open Channels.</strong></th>
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<td><strong>(22) Spatially Varied Flow</strong></td>
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**Text Books**

4. Flow through Open Channels by K. Subramanya
5. Flow through Open Channels by K.G. Ranga Raju
Classifications: Mechanical analysis – Sieve analysis, stoke’s law, hydrometer and Pipette Analysis Textural Classification, Structural Classification based on size – unified soil classification and modification by Bureau of Indian Standard.
B) Soil Hydraulics – Types of soil water capillary rise and surface tension, Darcy’s law and its limitations constant head and variable head permeameters pumping tests, Factors effecting coefficient of permeability, permeability of stratified soils. Total, neutral and effective stresses, No flow downward flow and upward flow conditions, quick sand conditions, critical hydraulics gradient.

UNIT – II: Stress distribution: Bousinesq’s theory for determination of vertical stress, assumptions and validity, extension to rectangular and circular loaded areas, 2: 1 approximate method, westergard’s theory Newmarks influence chart. Construction and use, contact pressure distribution beneath footings.
Consolidation: Oedometer Test, e-p and e-log p curves – compression index, coefficient of compressibility and coefficient of volume decrease. Terzaghi’s one dimensional consolidation theory assumption, derivation and application, coefficient of consolidation time curve fitting methods, initial compression, primary compression and secondary compression determination of preconsolidation pressure. Normally consolidated, over consolidated and under consolidated clays.

Subsoil Exploration : Methods of subsoil exploration Direct, semi direct and indirect methods, Soundings by Standard, Dynamic cone and static cone penetration tests, Types of Boring, Types of samples, Criteria for undisturbed samples, Transport and preservation of samples, Borelogs, planning of exploration programmes, report writing.

UNIT – IV: Shear Strength of Soils: Stress at a point, Mohr circle of stress, Mohr coulomb failure theory shear tests – shear box, unconfined compression, and triaxial compression tests, fieldvane shear tests, shear parameters, types of shear tests in the laboratory based on drainage conditions, shear strength of sands, critical void ratio and dilatancy, shear strength of clays, total stress analysis and effective stress analysis, skemptions pore pressure coefficients, stress paths.

TEXT BOOKS:
2. Soil Mechanics, Foundation Engineering by V.N.S. Murthy.
UNIT – I
Introduction: Importance and Necessity of Protected Water Supply systems, Objectives of Protected water supply system, Flow chart of public water supply system, Role of Environmental Engineer, Agency activities. Water Demand and Quantity studies : Estimation of water demand for a town or city, Types of water demands, Per capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design period, Population Studies, Population Forecasting Studies.

UNIT - II

UNIT - III

UNIT – IV

UNIT – V

References:
1. Environmental Engineering – Peavy, Rowe, Tchenobolus
2. Elements of Environmental Engineering – K.N. Duggal
4. Water Supply Engineering – Dr. P.N.Modi
5. Water Supply and Wastewater Engineering – Dr. B.S.N.Raju
7. Water Supply Engineering – Hussain
8. Water Supply Engineering – Chatterjee


UNIT – III: Detailed estimate of buildings. Different items of work in building; Principles of taking out quantities, detailed measurement form; long walls and shortwalls method of building estimate, Centre line method of building estimate. Estimate of RCC building, slope roof buildings; G.I. and A.C. Sheet, Detailed estimate of different types of doors and windows, electricity and water supply. Sanitation works etc.

UNIT – IV: Estimate of earth work; different formulae for calculations, estimate of metalled road, Tar road, concrete road, Railway tract, Estimate of culverts and bridges etc. Valuation of buildings; purpose, different method of building valuation; different terms used in valuation and their meaning.

REFERENCE BOOKS:
1. Estimation, Costing, Specifications and Valuation in civil Engineering by M.Chakraborti.
3. Textbook of estimating and costing by G.S. Birdie.

UNIT-II: Techniques to test the existing strengths: Destructive and non destructive tests on concrete.

UNIT-III: Repairs of Multistory structures: Cracks in concrete, possible damages to the structural element-beams, slab, Column, Footings, etc., Repairing techniques like Jacketing, Grouting, External prestressing, Use of chemical admixtures, Repairs to the fire damaged structures.


Reference:
UNIT-I: Concept of disaster management. Types of disasters. Disaster mitigating agencies and their organization structure at different levels. Overview of Disaster situations in India: Vulnerability profile of India and vulnerability mapping including disaster prone areas, communities and places.

UNIT-II: Disaster preparedness-ways and means; skills and strategies; rescue, relief, reconstruction and rehabilitation.


UNIT-IV: Landslide hazards zonation mapping and geo-environmental problems associates with the occurrence of landslides. A statistical approach to study landslides. Land causal factors in urban areas organization of mockdrills.

UNIT-V: Role of remote sensing, science & technology, Rehabilitation programmes, Management of Relief Camp, information systems & decision making tools, voluntary Agencies & community participation at various stages of disaster Management, School Awareness & Safety programme

Book:
1. “Natural Hazards in the Urban habitat” by lyengar, CBRI, Tata McGraw Hill
2. “Natural Disaster management”, Jon Inleton (Ed), Tulor Rose, 1999
Experiments on:

1. (a) pH.
   (b) Conductivity.
2. (a) Turbidity.
   (b) Jar Test.
3. Hardness.
5. Alkalinity estimation.
7. Fluorides.
10. D.O.
11. B. O. D.
12. C. O. D.
13. Chlorides.
CE318   GEOTECHNICAL ENGINEERING LABORATORY – I

No of Periods per Week: 0 L+ 3P
1. Atterberg limits
2. Field density by Core Cutter and Sand replacement method.
3. Grain size analysis
4. Hydrometer/pipette analysis.
5. Specific gravity by pycnometer/density bottle method.
6. Permeability of soil – Constant and variable head tests.
7. IS light compaction.

DEMONSTRATION EXPERIMENTS:

1. Consolidation test.
2. Quick sand model and others if any.
CE319 SOFT SKILLS
(COMMON WITH OTHER BRANCHES)

Communication:
Importance of communication
Non verbal communication
Personal appearance
Posture
Gestures
Facial expressions
Eye contact
Space distancing

Goal setting:
Immediate, short term, long term,
Smart goals, strategies to achieve goals

Time management:
Types of time
Identifying time wasters
Time management skills

Leadership and team management:
Qualities of a good leader
Leadership styles
Decision making
Problem solving
Negotiation skills

Group discussions:
Purpose (Intellectual ability, creativity, approach to a problem, solving, tolerance, qualities of a leader)
Group behaviour, Analysing performance

Job interviews:
Identifying job openings
Preparing resumes & CV
Covering letter
Interview (Opening, body-answer Q, close-ask Q),
Types of questions

Reference books:
1. ‘Effective Technical Communications’ by Rizvi M. Ashraf, McGraw–Hill Publication
2. ‘Developing Communication Skills’ by Mohan Krishna & MeeraBanerji, Macmillan
3. ‘Creative English for Communication’ by N.Krishnaswami&T.Sriraman, Macmillan
B. E. III / IV (CIVIL & CIVIL ENVIRONMENTAL ENGINEERING) SYLLABUS

2nd Semester:

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@Assessment as indicated along with the requirements given in the syllabus part.

FREE ELECTIVE – I.

ELECTIVE – II (COURSE NO. CE 326)

- CE326 A: Environmental Impact Analysis
- CE326 B: Structural Dynamics
- CE326 C: River Engineering
- CE326 D: Remote Sensing and Geographical Information Systems (G.I.S.)
- CE326 E: Environmental Impact assessment and Management of Water Resources Projects
- CE326 F: Optimization Techniques
No of Periods per Week: 4 L+ 2 T

UNIT – I: Analysis of statically indeterminate trusses (having not more than 7 members and 3 supports) containing (a) external redundant supports (b) internal redundant members using (i) method of consistent deformation of unit load method (ii) Castigliano’s theorem – II.

UNIT – II: Analysis of statically indeterminate frames (single storey, single bay portal frames only) using (I) slope-deflection method (ii) moment distribution method (iii) Kani’s method, (iv) Column Analogy.

UNIT – III: Arches: Normal thrust, radial shear and bending moment in three hinged and two hinged parabolic and segmental arches. Effects of rib-shortening and temperature change.

UNIT – IV: Suspension bridges: Stresses in loaded cables with supports at the same and different levels. Length of cable; Two and Three hinged stiffening girders.

UNIT – V: Introduction to matrix methods of structural analysis (Very elementary treatment only) Static indeterminacy, Kinematic indeterminacy, Stiffness and flexibility method for two span continuous beams only. – Truss with 3 supports and 7 members.

TEXT BOOKS:
1. Statically indeterminate structures – C.K. Wang
3. Indeterminate Structures by R.I. Jindal

UNIT – II: Water Tanks: Stress in concrete and steel in water tanks, Modular ratio, Impermeability requirements, Under ground rectangular tanks, Elevated rectangular and circular tanks, Design of these tanks for strength and cracking, Design of staging of rectangular tanks.


UNIT – IV: Piles and Pile caps: Design of bored cast in situ piles (bearing and friction types), under reamed piles. Pile Caps design; bending and truss methods.

UNIT – V: Prestressed Concrete – Reinforced Concrete Versus Prestressed Concrete. – Prestressing Systems (Fressinet, Gifford Udal, MagnelBlatten) – Prestressing Losses – Steel and Concrete for Prestressing – Homogeneous Beam Concept, limiting eccentricities, Pressure line, Elastic Stress distribution across the depth due to D.L. eccentric prestress and L.L.

TEXT BOOKS:
   1. Limit State of Design of Reinforced Concrete – P.C. Vergheese
UNIT – I: Plate Girders: Components of a plate girder, Economical depth, Design of flanges (flange area and moment of inertia methods), curtailment of flange plates, connection of flange angles to web and flange angles to flange plates.


UNIT – III: Bridges: Loadings, Deck type and through type bridges, Plate girder bridges, design of stringers, cross girders, wind bracings. Design of cross girder bridges, tension and compression members, joints, wind bracings. Bearings: Types of bearings, plate bearing, Rocker bearing, Roller bearing, Knuckle pin bearing.


REFERENCES:
Design of Steel structures – N. Subramanian, Oxford University Press.
Design of steel structures – Ramchandra (Vol. I & II)

UNIT – II: Pile Foundations: Types, Construction, load carrying capacity of single pile – Dynamic Formula, Static formula, Pile load tests, Load carrying capacity of pile groups, settlement of pile groups, Negative skin friction.


NOTE: This course does not cover structural design of foundations.

TEXT BOOKS:
1. Analysis, Design of foundations and Earth retaining structures by Shamsher Prakash, Gopal Ranjan and Swami Saran.
<table>
<thead>
<tr>
<th>UNIT I: Dimensional Analysis and Similitude.</th>
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<tbody>
<tr>
<td>(1) Fundamental Concepts of Dimensional Analysis</td>
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<tr>
<td>(2) Methods of Arriving at Dimensionless Groups.</td>
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<tr>
<td>(3) Examples in Dimensional Analysis</td>
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<tr>
<th>Unit II Hydraulic Machinery – I Turbines.</th>
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<tr>
<td>(6) Introduction and Classification of Turbines.</td>
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<tr>
<th>Unit III Hydraulic Machinery – II Centrifugal Pumps.</th>
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<tbody>
<tr>
<td>(11) Centrifugal Pumps</td>
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<tr>
<td>(12) Component parts &amp; Working principles of centrifugal pumps</td>
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<tr>
<td>(13) Work done by centrifugal pumps</td>
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<td>(14) Cavitation &amp; NPSH</td>
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</table>
Unit IV Hydraulic Machinery – III Reciprocating Pumps & Pump Performance.

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<tbody>
<tr>
<td>(17) Air Vessels and their principles</td>
<td>Air Vessels and their Effect, Modified Indicator Diagram in the presence of Air Vessels, Work Saved due to Presence of Air Vessel - Flow into and from Air Vessel.</td>
</tr>
<tr>
<td>(18) Performance characteristics of Pumps</td>
<td>Similarity Relations and Specific speed of Pumps - Performance Characteristics of Centrifugal Pump - Dimensional characteristics - Constant efficiency curves of Centrifugal Pumps.</td>
</tr>
</tbody>
</table>

UNIT V: Unsteady flows in Pipes & Open channels

| (20) Control of water hammer                    | Pressure conditions along the penstock – Mechanically operated relief valves, Surge tanks types, Design principles of Surge Tanks (Simple Surge Tanks only)                                                                                          |

Text Books

5. Hydraulic Transients by Richie
6. Hydraulic Transients by Streeter
CE326 ELECTIVE – II

CE326 A  ENVIRONMENTAL IMPACT ANALYSIS

University Examination: Duration 3 hrs.  Marks: 70
Sessional Marks: 30

No of Periods per Week: 4 L+ 2 T

UNIT – I: Introduction to EIA. Definition of EIA and EIS. Guidelines in USA, preparation of EIS, Elements of EIA (1 question either/or).

UNIT – II: Agency Activities, Environmental setting. Environmental attributes, air, water, soil, ecology, noise. Socio-Economic aspects, Culture and human aspects (Human settlements – rehabilitations) (1 question either/or).

UNIT – III: Environmental impacts, Identification measurement, Aggregation, Secondary and Cumulative Impacts (1 question either/or).

UNIT – IV: Criteria for selection of methodology, impact assessment methodologies, procedure for reviewing environment impact statement (1 question either/or).

UNIT – V: Case studies, Economic impact analysis energy production impact analysis, cost benefit analysis, Environmental impact mitigation and control measures. (1 question either/or).

REFERENCE BOOKS:


Text Book:
1) Structural Dynamics by Mario Paz

References:
1) Dynamics of Structures by R.W. Clough & J. Penzien
2) Dynamics of Structures by Anil. K. Chopra
3) Earth quake Engineeringby A.R. Chandrasekharn&Jaikrishna.
Regimes of Flow: Ripple and dune regime, antidune regime, importance of regimes of flow.  
Bed Load Transport: Bed load equations.  
Suspended Load Transport: General equation of diffusion, integration of sediment distribution equation, method of integrating curves of concentration X velocity, simple relations for suspended load.

UNIT – II: Bed Level Variation in Alluvial Streams: Continuity equation for sediment, equilibrium depth of scour in long channel contractions, general mathematical models, silting of reservoirs, local scour.  
Variation in Plan form of Streams: Secondary currents, flow in rigid boundary open channel bends, scour and deposition at Alluvial Bends, sediment distribution at channel bifurcations, meandering, lateral migration of Alluvial Streams cutoffs, delta formation.  
UNIT – III: Sediment control in Canals: Methods of sediment control.  
River Training: Objective of river training, river training for flood control, navigation, guiding the flow, sediment control, stabilization of rivers.  
Alluvial River Models, Debris Flows, Density Currents.


REFERENCES:  
RS in civil engineering projects: Topographic mapping: Geometric characteristics, digital elementary model, Cartographic requirements of satellite data, Mapping using SLAR. 

UNIT – II: INTRODUCTION TO GIS:
Introduction, GIS overview, Engineering of GIS applications, GIS components. 
Data Structures in Thematic maps:
Data structures for GIS, Data base structures, Data models, H,N,R query languages for data models. The nature of geographic data, spatial data models, Raster data models, Vector data models, Data base management for GIS, Data structures for Thematic maps. The choice between Raster and vector.

UNIT – III: DIGITAL ELEVATION MODELS:
Importance of DEM, Methods of DEM, Image methods, Data sources and sampling methods for DEM. 
DATA INPUT, VERIFICATION, STORAGE AND OUTPUT:
Data input, Data verification, Classification, and storage data output. 
DATA QUALITY, ERRORS AND NATURAL VARIATION:
Components of data quality, sources of errors, nature of boundaries, statical nature of boundaries, combining attributes from overland maps.

UNIT – IV: GIS ANALYSIS FUNCTIONS:
Introduction, Organization of data analysis, Classification of functions, maintenance and analysis of spatial data, Maintenance & analysis of nonspatial attribute data, integrated analysis of spatial & nonspatial data, output formatting, cartographic modeling. 
UNIT - V: CHOOSING AND IMPLEMENTING A GIS
Awareness, need for GIS, Developing system requirements, evaluation of alternative systems, system justification and development of an implementation plan, operational system.

REFERENCE BOOKS:
Geographic Information systems a management perspective Stan Aronoff (WDL Publications, Ottawa, Canada). 
Remote sensing in civil engineering – Kennie, J.J.M., Matthews, M.C. 
Energy flow in ecosystems: Solar energy, trophic structure.
Biological building blocks: Nutrients - Macro and Micro, carbon, nitrogen, and phosphorus cycles.
Ecosystems of the world: Terrestrial systems, Estuary; Marine and Wetland Systems; relationships within the ecosystems.
Biotic and abiotic interactions, Nature’s resilience.
Biogeographic regions: Forests, grasslands, deserts, Biomass productivity, agroclimatic zones.
Global econcerns Climatic changes, greenhouse effect, ozone layer depletion.

Illustrative Examples. Nature of Impact, Adverse and beneficial, reversible and irreversible, short term and long term impacts.
Identification: Environmental reconnaissance, Environmental examination, and Environmental studies during planning, design and operation of projects.
Attributes (Parameters): Air; microclimate, Water; surface water and ground water, Land; erosion, salinization, waterlogging, subsidence. Ecology; Terrestrial and aquatic flora and fauna; Human Aspects; Displacement, rehabilitation; noise pollution, project related hazards; Base line data collection.
Prediction: Qualitative methods based on past experience, quantitative methods based on mass balance and mathematical models.
Assessment: Scoping, adhoc methods, checklists, matrix methods, index method, networks, simulation and modelling, environmental evaluation system, cost benefit analysis.

Rehabilitation and Resettlement: Provision for equivalent or better standard of living, cultural, social, educational and medical facilities; live stock management; forest preservation and enhancement. Contingent plans for unforeseen dislocation.
Preventive and Remedial Measures: Saline, alkaline and waterlogged soils; extent, distribution and mode of formation; reclamation procedures, use of chemical amendments in alkali soils, surface and subsurface and vertical drainage system for saline soils; disposal of saline drainage effluent into water bodies, evaporative ponds and deep injection wells, desalination by physical, chemical and biological treatment; reuse of saline drainage effluent, salt tolerant crops, agroforestry, aquaculture.
Lining of water distribution networks, land levelling, On Farm Water management, sprinkler and drip irrigation methods, scheduling of irrigation based on crop water requirements, crop management, biodrainage, water pricing, reallocation of water to other sectors.

UNIT – IV: Conjunctive use of groundwater and surface water: Transportation of ground water to water scarce areas, cycling and blending approaches.
Soil and Water Conservation: Erosion control, contour bunding and terracing, pasture development, afforestation, checkdams, strip cropping, agronomic practices, recycling and reuse of water, water harvesting.
Maintenance of Minimum Flow: Quality and quantity for downstream use, development of fisheries and recreational facilities.
Health hazard Mitigation: Measures against water related diseases, vector control, risk analysis.
Waste Land Development: Types of wastelands and their distribution, utilisation of wasteland for forestry, pasture.
Major Legislation in Direct and Related Areas: Awareness of legislation in respect to water quality, waste disposal, air pollution, groundwater exploitation, forestry, wild life and other environmental impact parameters.
Public Participation: Possible roles for individuals, communities and institutions; appropriate areas; public relations, aspects; role of local and outside leadership; nongovernmental organisations.
TEXT BOOKS & REFERENCES:

Ecological Concepts:


Impact Assessment:


Management and Enhancement Measures:


GENERAL REFERENCE:
Silenced Rivers – Patrick Mc Cully; Orient Longman Publications.
CE326 F  

OPTIMIZATION TECHNIQUES.

University Examination: Duration 3 hrs. Marks 70
Sessional Marks: 30

No of Periods per Week: 4 L+ 2 T

1. Introduction: Need and scope of optimization. Historical Development. Statement of optimization problems. Objective function and its surface, design variables, constraints and constraint surface. Classification of optimization problems (Various "functions) continuous, discontinuous and discrete) and function behaviour (Monotonic, Non-monotonic and unimodal).

2. Classical optimization techniques: Differential calculus method, multivariable optimization by method of constrained variation and Lagrangean multipliers (generalised problem). Kuhn-Tucker conditions for optimality,


4. Linear programming - Definitions and theorems - Simplex method - Duality in Linear programming. Plastic analysis and minimum weight design and rigid frame.

Reference:
No of Periods per Week: 0 L + 3P

(1) Field identification & classification of soils
(2) Unconfined compression test
(3) CBR test/plate bearing test
(4) Triaxial compression test
(5) Direct shear test
(6) Vane shear test
(7) Relative density
(8) Triaxial test
(9) Differential freeswell and swell pressure test.
(10) Consolidated drained
(11) Demonstration experiments (subject to availability)
(12) S.P.T.
(13) Consolidated undrained Foundation models
(14) Plate load test
(15) Pressuremeter test
(16) Field vane shear.
1) Specific gravity and unit weight of cement
2) Specific gravity and unit weight of coarse and fine aggregates.
3) Determination of normal consistency of cement
4) Determination of initial and final setting time
5) Fineness of cement.
6) Determination of compressive strength of cement (for different grades of cement).
7) Bulking characteristics of sand.
8) Sieve analysis of coarse and fine aggregates and classification as per IS 383.
10) Tests on Hardened concrete.
11) Compressive Strength
12) Split tensile strength
13) Modulus of rupture
14) Design of concrete mix by using IS code method (for class work only)
15) Case studies on a) framed structures and b) plate girder bridges.

INDUSTRIAL TRAINING
To be held during summer vacation at the end of second semester of III year and evaluated in the 1st Semester of IV year
### B. E. IV / IV (CIVIL ENGINEERING) 1st SEMESTER

<table>
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<th>Course Code</th>
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<td>CE417</td>
<td>Transportation Engineering Lab.</td>
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<td>CE419</td>
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### ELECTIVE – III (COURSE NO. CE 416)

- CE416 A Industrial Structures
- CE416 B Multistorey Structures
- CE416 C Elements of Solid Waste management
- CE416 D Soil Dynamics & Machine Foundation
- CE416 E Principles of Water Quality Management
- CE416 F Port and Harbour Engineering

The total marks for the semester are 900 credits.
UNIT – I INTRODUCTION AND HYDROLOGICAL ASPECTS:
Water Resources in India, Hydrology in water Resources Planning – Hydrologic Planning – Precipitation – Types, Measurement of rainfall, Average depth of rainfall over an area, Mean annual rainfall, Analysis of Rainfall Data- Consistency of rainfall record – Double mass curve, Depth –Intensity, Depth h area duration curves.

Infiltration – Factors affecting and its determination, Infiltrometers

Evaporation and Evapo – Transpiration. Pan evaporation, Consumptive use, determination of evapotranspiration – Blenney&Creeddle, Penmann and Hargreeaves methods.

Runoff – Factors affecting runoff, methods of determination of runoff, stream gauging, hydrograph analysis, base flow separation, unit hydrographs – Hydrograph of different durations, applications of unit hydrograph, S-hydrograph.

UNIT II – GROUND WATER FLOW:
Mechanics of interstitial flow, definitions, sub surface distribution of water, ground water movement, Darcy’s law – permeability, intrinsic permeability well hydraulics – Steady flow into different types of aquifers and wells – Determination of hydraulic properties of aquifer, Well losses, specific capacity of well, and well efficiency, pumping tests- Recuperation test method for determination of well yield.

Methods of construction of open well-yield of an open well – methods of construction of tube wells, well shrouding and well development, spacing of tube wells, design of tube well – pumping requirements, centrifugal and bore hole type pumps – collector wells.

UNIT III – RESERVOIR PLANNING:
Types of reservoir- Investigations for reservoir planning, Selection of site for a reservoir, Zones of storage in a reservoir, Purpose of reservoir, Design studies, Reservoir regulation, Reservoir yield, Mass curve and Demand curve, Determination of reservoir capacity, yield from a reservoir of given capacity, operating schedules, RuleCurve for reservoir operation, Economics of Waterresources Projects, Apportionment of total cost of a Multi Purposeproject, Benefit -Cost Ratio.

Reservoir Losses – Measures to reduce evaporation loss in reservoirs sedimentation, control of reservoir sedimentation.

UNIT IV - IRRIGATION:
Definition of irrigation, Types of irrigation systems – Direct and Indirect, Lift and Inundation irrigation Systems, Methods of irrigation – Surface and Sprinkler methods, Trickle or Drip Irrigation, Soil moisture Constants, Depth of water held by soil in different zones, Water extraction - Quality of irrigation water


UNIT V – CANAL SYSTEMS:

Regulation of channel system – Canal outlets, Requirements of a good outlet – Types of outlets, Water logging-
Causes and control – land drainage, canal lining – methods, design of lined canals, canal navigation – requirements, methods to make navigability feasible.

REFERENCE BOOKS:
1) Water resources engineering – B.C. Punmia.


UNIT IV: Airport Engineering: Layout of Airports – Components functions – Aircraft characteristics – Airport site selection – Airport obstructions – Runway design – Visual aids – Air traffic control.

REFERENCE BOOKS:

1) Highway Engineering by Khanna & Justo.
2) Highway Engineering by Sharma & Sharma.
3) Airport planning and Design by Khanna & Arora.
UNIT I: PERT and CPM: Introduction: Origin of PERT and CPM, Planning, Scheduling and controlling Bar charts, Milestone charts, weaknesses in Bar charts, PERT and CPM networks – Comparison, Event, Activity, Rules for drawing networks, Numbering the events (Fulkerson’s law: Dummy activities, Time estimate-Expected time, Earliest allowable occurrence time, Latest allowable occurrence time, slack, project duration, probability of completion, Start and Finish time estimates, Floats, Project scheduling, Critical and sub-critical path.


REFERENCE BOOKS:
1) PERT and CPM – L. S. Srinath.
2) PERT and CPM – Punmia.
4) Construction Management and Planning – Gun and Sen Gupta, B.


TEXT BOOKS:

4. Sewage treatment and disposal by Dr. P.N. Modi.
5. Water supply and Waste Water Engineering by Dr. B.S.N. Raju
GENERAL: Data Base management in Civil Engineering Applications. Creation of Data Tables and Retrieval of Data using Structured Query Language.

UNIT I: Determination of Bending Moment Diagram, Deflections for different loading conditions for a Simply Supported Beam and Cantilever Beam. Determination of fixed end moments for different loading conditions of a fixed beam. Calculation of Influence line diagrams at any section of a Simply Supported Beam.

UNIT II: Estimation of Run off for a Catchment. Estimation of Friction factor for Laminar and Turbulent flows, Minor losses in pipe flow. Conversion of Angles from WCB to RB. Classification of Soils. Determination of coefficient of permeability, Degree of Consolidation and Shear Strength.


TEXT BOOKS:
1) Computer aided design, software and analytical tools by C.S. Krishnamoorthy & S. Rajesh.
2) Computer applications in Civil Engineering by S.K. Parikh.
3) Computer aided design in Reinforced concrete by V.L. Shah.
CE416 ELECTIVE – III

CE416A  INDUSTRIAL STRUCTURES

No of Periods per Week: 4 L+ 2 T

UNIT – I: Connections: Design of Frame, seated moment resisting connections(both welded and riveted).

UNIT – II: Analysis of Pitched (Gable) Portal frames, Assumptions, Bending Moment and Shear Force diagrams. Design of portal frame (dead, live and wind loads).

UNIT – III: Analysis and design of gantry ginders, Steel Bracket design.


UNIT – V: Analysis of Mill Bends

TEXT BOOKS:
1. Design of Steel Structures by M. Raghupati.
2. Design of Steel Structures by Arya and Azmani.
3. Design of Steel Structures by P. Dayaratnam.
4. Design of Steel Structures by Kazmi and Zindal.

CE416 B  MULTISTOREYED STRUCTURES

No of Periods per Week: 4 L+ 2 T

UNIT – I: Analysis of Portal Frames by Moment Distribution Methods with and without sway Analysis of continuous beams and one bay one storey Frames by Kani’s method with and without sway.

UNIT – II: Introduction to Matrix methods: Analysis of continuous beams and one bay one storey portal frames by stiffness method.

UNIT – III: Analysis of one bay one storey portal frames and continuous beams by Flexibility matrix methods.

UNIT – IV: Analysis of Multistoreyed frames by substitute frame method.

UNIT – V: Analysis of Multistoreyed frames for wind loads by portal, cantilever and Girder Factor methods.

(For Saessional Work only)
Introduction to shear walls, Different types – Behaviour of cantilever walls with rectangular cross section – Flanged shear walls.
1. Analysis of Indeterminate structures – C. K. Wang
UNIT 1 : INTRODUCTION: Definition of solid waste, garbage, rubbish- Sources and Types of solid wastes. Characteristics of Solid Wastes: Physical, chemical and biological characteristics- Problems due to improper disposal of solid waste.

UNIT 2 : SOLID WASTE MANAGEMENT: Definition- Reduction, reuse, recycling and recovery principles of waste management- Functional elements of Solid Waste management- Waste generation and handling at source- Collection of solid wastes- Collection methods and services- guidelines for collection route layout.

UNIT 3 : TRANSFER AND TRANSPORT OF WASTES: Transfer station- Processing and segregation of the solid waste- various methods of material segregation.


Reference Books: Integrated Solid Waste Management by Tchobanognous
Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Tchobanognous

CE416 D SOIL DYNAMICS AND MACHINE FOUNDATIONS

UNIT – I: Types of machine foundations – General requirements, Design criteria for machine foundations, Permissible amplitudes and bearing pressures.
Resonance and its effect – free and forced Vibrations with and without damping – Constant force and rotating mass type excitation – Magnification factor – Phase difference between forces and displacement for steady state vibrations – Logarithmic decrement.

UNIT – II: Natural frequency of foundation – soil system – Barkan’s and I.S. methods of determining natural frequency. Tachechotarioff’s reduced natural frequency.
Elastic properties of soil for dynamical purpose and their experimental determination of shear modulus from wave theory.

UNIT – III: Apparent soil mass – bulb of pressure concept – Pauw’s analogy of foundation – soil system (charts to be supplied for solving problems).


REFERENCES:
2) I.S. Codes.
4) Analysis and design of Foundations and Retaining Structure by Shamsherprakash, Gopal Ranjan and Swamisaran – M/s SarithaPrakashan, Meerut.
CE416 E  PRINCIPLES OF WATER QUALITY MANAGEMENT

University Examination: Duration 3 hrs.  Marks: 70

No of Periods per Week: 4 L+ 2 T

Sessional Marks: 30


UNIT 2  : Modeling the fate of pollutant in natural water: Fundamentals of process and mechanisms- Conventional Streeter-Phelps BOD-DO models, Critical deficit and time required to reach the critical deficit.

UNIT 3  : Fundamentals of ground water flow – variations of ground water levels, fluctuations due to Evapotranspiration, Meteorological phenomena

UNIT 4  : Groundwater pollution and management – Sources of ground water pollution and their effects – municipal, industrial, agricultural and miscellaneous, ground water basin investigations. Groundwater modeling techniques.


Reference Books:
1. Ground Water Technology by B. K. Todd.
2. An introduction to Water quality modelling. James,A.
3. Surface water quality modeling by Chopra, S.C
Unit – I

Description and formulation of waves and tides in the ocean, Linear wave theory, wave generation, wave transformation; Shoaling, refraction, diffraction and reflection, wave prediction techniques, Long waves in irregular shaped basins or bays, harbor oscillations.

Unit – II

Growth and regulation of ports. Various components of maritime systems, including shorefront and inlan infrastructure, Docks and Repair facilities, Concepts of port and marine terminal design, cargo handling equipment and intermidal transportation networks.

Unit – III


Unit – III

Foundamentals of port structures design, design codes, guidelines and functional requirements. Structural, geotechnical, and materials considerations, for a variety of environmental conditions, including extreme wave and current environments, ice, and seismic loading.

Unit – IV

Functional desing of the various components of ports and marine terminals, including steel, concrete, timber, and stone structures. Design procedures for breakwaters, bulkheads, wharves, dolphins, piers, fender and mooring systems and revetments.

Unit – V

Marine and offshore construction equipment: Basic motions of swaway Barges, crane barges, offshore derrick barges, semisubmersible barges, Jack-up construction barges, launch barges, pipe laying barges, floating concrete plant. Pile driving equipment.

Reference Books / Text Books
1. Port Engineering, by Per Bruun
2. Design and construction of Ports and Marine Structures, by A.D. Qinn, Mc Graw-Hill
3. PHRI (Port and Harbour Research Institute) Japan manual.
4. Handbook of Port HarbourEngineering: Geotechnical and structural aspects, by Gregory Tsinker
No of Periods per Week: 0L+ 3P


2) **Testing of bitumenous material**: Specific gravity – Penetration value – Viscosity value – Softening point – Ductility value – Flash and Fire point.


**REFERENCE BOOKS:**

1) Highway material testing by Khanna & Justo.
1) Characteristics of a hydraulic jump. - To measure and draw $Y_2/Y_1$, $(E_1 - E_2)/E_1$, $Lj/(Y_2-Y_1)$ as a function of $F_r$, and compare with theoretical results wherever possible.

2) Canal transitions – To measure the depth of water in canal transitions (a) with a reduction of bed width and (b) With a rise in bed level.

3) Pipe friction. (a) To measure the piezometric head variation along the length of a pipe and compute Darcy-Weisbach f. (b) To plot H.G.L and T.E.L.

4) Drag characteristics of a circular cylinder with its axis normal to the direction of flow. 
   (a) To measure the pressure distribution on the surface of a cylinder and plot the dimensionless pressure variation around the cylinder and compute the pressure drag.
   (b) To measure the velocity variation in the wake of the cylinder, velocity of approach, and compute the total drag by momentum principle.

5) Performance characteristics of a centrifugal pump. - To measure the discharge, head developed, and power input at various discharges for centrifugal pump and draw the performance characteristics.

6) Performance characteristics of a reciprocating pump.

7) Performance characteristics of a Pelton / Francis / Kaplan turbine. - To measure the discharge, head difference across the turbine, the brake load, speed of turbine for various discharges and draw the performance characteristics.

8) Impact of a jet on bodies.
CE419   INDUSTRIAL TRAINING

The students are supposed to submit a detailed report covering the following aspects related to civil engineering projects that are relevant to the industry in which they received training:

- Project Planning,
- Design,
- Scheduling,
- Specifications,
- Tender Document Preparation,
- Calling of Tenders,
- Material Procurement Methods / Practices,
- Inventory, Stores Maintenance and Material Issue Norms,
- PERT / CPM Details,
- Project Execution,
- Check Measurement,
- Project Management,
- Quality Control,
- Safety and Risk Analysis and
- Maintenance, Repairs and Operation.

The report will be evaluated for 100 marks by a viva-voce committee comprising of the following members:

- Head of the Department
- Two internal Examiners
- One external examiner and
- Chairman Board of studies.
### B. E. IV / IV (CIVIL & CIVIL ENVIRONMENTAL ENGINEERING) SYLLABUS

#### 2nd Semester:

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<th>Course Code</th>
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**ELECTIVE – IV (COURSE NO. CE 423)**

- CE423 A Advanced Concrete Structures
- CE423 B Prestressed Concrete
- CE423 C Air Pollution Control
- CE423 D Ground Improvement Techniques
- CE423 E Coastal Engineering
- CE423 F Hydraulic Structures

CE 424* Irrigation Structures, Design and Drawing: The fifty marks allocated for the Subject shall be considered as Semester end examination marks conducted by internal examiner only.
B. E. IV / IV (CIVIL ENGINEERING) 2 \textsuperscript{nd} SEMESTER

CE421 TRANSPORTATION ENGINEERING– II

University Examination: Duration 3 hrs. Marks: 70
No of Periods per Week: 3 L+ 1 T
Sessional Marks: 30


REFERENCE BOOKS:
2) Railway Engineering by Rangwala.
3) Dock &Harbour by Birdie.
4) Tunnelling by Rangwala.
UNIT – I Storage Works: Classification of dams, factors governing selection of types of dam, selection of site, preliminary investigation.

UNIT – II Earth Dams: Types, foundation for earth dams, design of earth dams, causes for failure of earth dams, criteria for safe design, phreatic line, seepage analysis – seepage control through body and foundation.
Spillways: Essential requirements, spillway capacity, components, types of spillways and their working, design of ogee spillway, energy dissipation below spill way, scour protection, use of hydraulic jump as energy dissipater – design of stilling basins – USBR and IS standard basins - spillway crest gates, different types.

UNIT – III Diversion Head Works: Types, location and components, effects of construction of weirs on permeable foundation, Bligh’s, Lanes and Khosla’s theories, Method of independent variables, design principles of weirs and barrages, design of weirs on permeable foundations, design of vertical drop weir, canal head regulator, silt control devices.
Regulation Works: Canal falls, definition necessity and location, classification of falls, design principles of syphon well drop, notch fall, sarada fall, straight glacis fall, offtake alignment, cross regulator and distributary head regulator.
Cross Drainage Works: Types, factors affecting the suitability of each types, classification of aqueducts, design principles of different types of aqueducts.

UNIT – IV River Training Works: River Training and its objectives, classification of river training works, marginal embankment, guide banks, groynes, cutoffs, bank pitching, launching aprons, miscellaneous types of river training works.
Water Power engineering: Development of hydro power in India, assessment of available power, utilisation factor, load factor, diversity factor, storage and pondage, types of hydro power schemes, components of hydel schemes – fore bay, intake structure, trash racks, surge tanks, water hammer pressure, sub structure and super structure of power house.

REFERENCE BOOKS:
1) Water resources engineering– B.C. Punmia.
CE423 ELECTIVE – IV

CE423 A  ADVANCED CONCRETE STRUCTURES

University Examination: Duration 3 hrs. Marks: 70
Sessional Marks: 30

No of Periods per Week: 4 L+ 2 T

UNIT – I: Yield Line Analysis: Analysis and Design of Slabs using yield line theory. Slabs supported on four edges, three edges and two opposite edges subjected to uniformly distributed load.

UNIT – II: Grid Floor: Analysis and Design of Grid Floors as per IS Code and more rigorous method.

UNIT – III: Design of Bunkers and Silos.

UNIT – IV: I.S. Code provisions for ductility of concrete structures, Serviceability requirements with regard to deflection and crack width.

UNIT – V: Flat Slabs – Different Components of a Flat Slab, Direct Design Method, Bending Moments in the interior and end Spans.

TEXT BOOKS:

1) Advanced Reinforced Concrete designed by N. Krishnam Raju.
2) Design of Reinforced Concrete Structures by P. Dayaratnam.
3) Reinforced Concrete Structures by Paurk and Pauly.

UNIT – II: Prestressing losses, Elastic shortening, loss due to shrinkage, loss due to creep, loss due to friction, loss due to curvature etc. I.S. code provisions.

UNIT – III: Analysis of prestress members, assumptions, pressure, or thrust line concept of load balancing, cable profile, kern distance, stress in tendons as per IS 1343, cracking moment.

UNIT – IV: Limit state design of flexural members, stress, I.S. code provisions, design of symmetrical beams, design of prestressed concrete poles, design for shear, I.S. code provisions.

(b) Anchorage zone in post tensioned members, stress distribution in end block, Guyon’s method of approach of analysis of end block (Not more than 2 cables).

TEXT BOOKS:
1) Prestressed Concrete by P. Dayaratnam.
UNIT – I: Air Pollution and its definition – Factors influencing air pollution – Classification of pollutants particulates – Gases - Sources of pollution – Air qualities standards – effects – Location of Industries.


UNIT – III: Air Pollution effects on human beings, animals, plants and materials – Air Pollution Episodes in India and abroad.

UNIT – IV: Ambient air quality monitoring and stack monitoring.

UNIT – V: Control of air pollution – Removal of pollutants – particulate and gaseous – Air pollution control equipments (units) such as setting chamber, cyclones, wet scrubbers/collectors, scrubbers, centrifugal scrubbers spary towers, packed beds, electrostatic precipitators, after burners-absorption – adsorption – Diffusion.

REFERENCES:
1) Air Pollution Control Technology by T. Painter.
2) Elements of Air Pollution Control by Prof. T. Shivaji Rao.
3) Air Pollution Control by K.V.S.G. Murali Krishna.
4) Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H.
In-situ Densification methods in cohesive soils, introduction, preloading or dewatering, drainwalls, sand drains, sand wicks, geodrains/banddrains, stone and lime columns, forced vacumpreconsolidation, thermal methods.


UNIT – III: Geotextiles: Introduction, types of geotextiles; Functions and their application, tests for geotextile materials, geogrids, functions.
Mechanical stabilization: Soil aggregate mixture, properties and proportioning techniques, soft aggregate stabilization, compaction, field compaction control. Cement stabilization, Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques.

UNIT – IV: Lime and Bituminous Stabilization: Types of admixtures, mechanism, factors affecting, design of mixtures, construction methods.
Stone columns, introduction, construction practice, design principles, vibrofloatation techniques and other techniques like dynamic replacement etc.

REFERENCE BOOKS:
2) E. J. Yoder: Principles of pavement design, John Wiley and sons.
UNIT – I: Mechanics of Wave Motion: Wave fundamentals and classification of waves, small amplitude wave theory, wave celerity, length, and period, orbital motions, pressure distribution, wave trains and wave energy, transformation of waves, higher order wave theories, stokes higher order wave theories, cnoidal wave theory, wave refraction, wave diffraction, wave reflection, wave breaking.

UNIT – II: Tides, Storm surges, Tsunamis - Wave Prediction: Wave height variability, energy spectra of waves, directional spectra of waves, wind information needed for wave prediction, estimating the wind characteristics, delineating a fetch, forecasts for lakes, bays, and estuaries, significant wave method, wave spectrum method, forecasting wind waves in shallow water, deep water relation for wave decay, hurricane waves.

UNIT – III: Littoral Processes: Ocean currents, long shore currents and setup due to ocean waves, sediment transport in the offshore zone, surf zone, bar-berm prediction and budget of the littoral zone.

UNIT – IV: Wave runup, overtopping and transmission - Wave Forces: Wave forces on cylinders and walls.

REFERENCES:
UNIT – I: Straight Gravity concrete Dams: Single-step design, multiple-step design, Internal stresses in gravity
dams, stress distribution around openings, stress distribution around a circular hole in an infinite plate due to a
normal stress on the plate, stress distribution around a horse shoe shaped gallery using phillips and zanger’s tables,
design of reinforcement around galleries in dams.
Arch Dams: Economic central angle of an arch dam, constant radius method, constant angle method, and variable
radius and variable angle design of arch dams, trial load method of analysis of arch dams.

UNIT – II: Earth Dams: Seepage analysis, stability analysis of infinite slopes with and without seepage, stability
analysis of finite slopes – friction circle method, method of slices, ordinary method of slices, simplified Bishop
method of slices, spencer’s method.
Spillways: Hydraulic design of ogee spillways, comprehensive discharge characteristics of ogee spillways, design
of reinforcement in the crest region of an ogee spillway, hydraulic design of chute spillways, morning glory
spillways, side channel spillways.
Stilling basins and energy dissipaters: Intake Structure:

UNIT – III: Water Conductor System: Selection of type of water conductors, economic analysis for determination
of sizes of water conductors, analysis and design of lined pressure tunnels, water hammer analysis, analysis and
design of surge tanks of various types, design of anchor blocks for penstocks, design of penstock junctions, design
of scroll cases and draft tubes.

UNIT – IV: Gates and Valves: Vertical lift gates, tainter gates, cylindrical gates, butterfly valves, Howell –
Bunger valves, needle valves, flow induced forces on vertical lift gates, flow induced vibration of vertical lift gates.
Layout of Power Houses.

REFERENCES:
1945.
4) Davis and Sorensen, Handbook of applied hydraulics.
5) Lambe and Whitman, Soil Mechanics.
IRRIGATION STRUCTURES – DESIGN AND DRAWING (SESSIONAL WORK ONLY)

No of Periods per Week: 0 L + 4 D

(a) Tank surplus weir ; (b) Barrage ; (c) Glacis type of canal drop ; (d) Notch Fall ; (e) Syphon Aqueduct (type III) (f) Cross regulator and head regulator

TEXT BOOKS:
3) Type Designs of Irrigation Structures _ R.S.N. Murthy.

CE425 PROJECT WORK

No of Periods per Week: 0 L + 6T

University Examination VIVA VOCE Marks: 50
Sessional Marks: 50