CEU301 STRUCTURAL ANALYSIS II

Prerequisite CEU 211 Structural Analysis I

**Force method of analysis of indeterminate structures (10 hours)**
Analysis of rigid frames of different geometry by consistent deformation method - settlement effects - analysis of pin-jointed trusses by consistent deformation method - externally and internally redundant trusses - effects of settlement and prestrains.

**Displacement method of analysis of indeterminate structures (12 hours)**
Slope deflection method - analysis of continuous beams - beams with overhang - analysis of rigid frames - frames with sloping legs - gabled frames - frames without sway and with sway - settlement effects - moment distribution method as successive approximation of slope deflection equations - analysis of beams and frames - non-sway and sway analyses - Kani’s method as iterative method of analysis of frames (outline only)

**Moving Loads & Influence Lines (11 hours)**
Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams - influence lines for forces in trusses - analysis for different types of moving loads - single concentrated load - several concentrated loads - uniformly distributed load shorter and longer than the span

**Cables, suspension bridges & arches (9 hours)**
Analysis of forces in cables - suspension bridges with three-hinged and two-hinged stiffening girders - theory of arches - Eddy’s theorem - analysis of three-hinged and two-hinged arches - settlement and temperature effects.

**References**
9. Rajasekaran S. & Sankarasubramanian G., Computational Structural Mechanics, PHI
**CEU302 PRINCIPLES OF STRUCTURAL DESIGN**

Prerequisite CEU 214 Functional Design of Buildings

**Module I (11 hours)**

**Design Philosophy**

**Module II (11 hours)**

**Reinforced Concrete**

**Module III (10 hours)**

**Steel**
Steel - introduction to connections - analysis and design of riveted, bolted and welded joints for direct force and moment - struts and ties made of single and double angles.

_A design project involving the design and detailing of a typical connection is envisaged at this stage._

**Module IV (10 hours)**

**Timber**
Classification and allowable stresses - design of beams for flexure, shear & bearing - deflection criteria - design of solid and built-up columns-flitched beam – formwork design.

_A design project involving the design and specification of the formwork for a typical concrete structure is envisaged at this stage._

**References**
11. BIS Codes ( IS 875, IS 10262, SP 23, IS 456, IS 800, SP 6, IS 883, IS 2750).
CEU303 GEOTECHNICAL ENGINEERING I

Module I (11 hours)
Nature of soil and functional relationships: Soil type - Concepts of single grained, honey combed and flocculent structure and their effects on the basic soil properties - 3 phase system - void ratio - specific gravity - dry density - porosity - water content - saturated unit weight - submerged unit weight - degree of saturation
Laboratory and field identification of soils: Determination of water content by oven drying - Specific gravity using pycnometer and specific gravity bottle - Grain size analysis by sieve analysis, hydrometer analysis and pipette analysis - Atterberg limits and indices - Visual identification by simple field tests - Field density by core cutter, sand replacement and wax coating methods
Classification of soils: Necessity - Principles of classification - I.S. classification - Plasticity charts - Group index

Module II (10 hours)
Soil water: Types - Effective stress - Total stress - Pore pressure - Pressure diagrams
Permeability: Definition - Darcy’s law - Factors affecting permeability - Laboratory determination - Stratified soils: average permeability.
Stress distribution: Boussinesq’s equations for vertical pressure due to point loads - Assumptions and limitations - pressure bulb - Influence diagram - Vertical pressure due to uniformly distributed loads, line loads and strip loads - Newmark charts and their use - Westergaard’s solution.

Module III (10 hours)
Consolidation: Definition - Concepts of coefficient of compressibility - Coefficient of volume change and compression index - e-log p curves - Terzaghi’s theory of one dimensional consolidation - Determination of coefficient of consolidation - pre-consolidation pressure difference between consolidation and compaction
Compaction: Definition and objectives of compaction - Proctor test and modified proctor test - Concept of OMC and maximum dry density - Zero air voids line - Factors influencing compaction - Effect of compaction on soil properties - Field compaction methods - Proctor needle for field control.

Module IV (11 hours)
Shear Strength: Definition - Mohr’s strength and stress circles - origin of planes - Mohr’s envelope - Mohr-Coulomb strength theory - Direct, triaxial and UCC tests - Drainage conditions - Measurement of pore pressure - Vane shear tests - Total and effective stress - Strength parameters - Stress path, Liquefaction of sand - Choice of test conditions for field problems
Stability of slopes: Slope failure, base failure and toe failure - Swedish circle method - $\phi=0$ analysis and $c=0$ analysis - Friction circle method - Taylor’s stability number - Stability charts - Sliding block analysis.

References
5. Khan I.H., Text Book of Geotechnical Engineering, Prentice Hall of India
ZZU301 ENVIRONMENTAL STUDIES

Unit 1: Multidisciplinary nature of environmental studies (2 lectures)
Definition, scope and importance, need for public awareness.

Unit 2: Natural Resources: Renewable and non-renewable resources:
Natural resources and associated problems.
a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
• Role of an individual in conservation of natural resources.
• Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems (8 lectures)
• Concept of an ecosystem.
• Structure and function of an ecosystem.
• Producers, consumers and decomposers.
• Energy flow in the ecosystem.
• Ecological succession.
• Food chains, food webs and ecological pyramids.
• Introduction, types, characteristic features, structure and function of the following ecosystems:
a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit 4: Biodiversity and its conservation (8 lectures)
• Introduction – Definition: genetic, species and ecosystem diversity.
• Biogeographical classification of India
• Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values
• Biodiversity at global, National and local levels.
• India as a mega-diversity nation
• Hot-sports of biodiversity.
• Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
• Endangered and endemic species of India
• Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Unit 5: Environmental Pollution (8 lectures)
Definition
• Cause, effects and control measures of :-
  • Air pollution
  • Water pollution
  • Soil pollution
  • Marine pollution
  • Noise pollution
  • Thermal pollution
  • Nuclear hazards
• Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
• Role of an individual in prevention of pollution.
• Pollution case studies.
• Disaster management : floods, earthquake, cyclone and landslides.

Unit 6: Social Issues and the Environment (7 lectures)
• From Unsustainable to Sustainable development
• Urban problems related to energy
• Water conservation, rain water harvesting, watershed management
• Resettlement and rehabilitation of people; its problems and concerns. Case Studies
• Environmental ethics : Issues and possible solutions.
• Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
• Wasteland reclamation.
• Consumerism and waste products.
• Environment Protection Act.
• Air (Prevention and Control of Pollution) Act.
• Water (Prevention and control of Pollution) Act
• Wildlife Protection Act
• Forest Conservation Act
• Issues involved in enforcement of environmental legislation.
• Public awareness.

Unit 7: Human Population and the Environment (6 lectures)
• Population growth, variation among nations.
• Population explosion – Family Welfare Programme.
• Environment and human health.
• Human Rights.
• Value Education.
• HIV/AIDS.
• Women and Child Welfare.
• Role of Information Technology in Environment and human health.
• Case Studies.
Unit 8: Field work

- Visit to a local area to document environmental assets river/ forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Field work Equal to 5 lecture hours)

References

2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad –380 013, India, Email:mapin@icenet.net (R)
7. Down to Earth, Centre for Science and Environment (R)
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
17. Survey of the Environment, The Hindu (M)

M(Magazine); R(Reference); TB(Text Book)
CEU305 TRANSPORTATION ENGINEERING II

Prerequisite CEU 215 Transportation Engineering I

Module I (10 hours)
Components & Geometric Design of Railways: Introduction - Typical cross-sections - Various gauges - Coning of wheels and tilting of rails - Functions and requirements of component parts of a railway track - Creep of rails - Geometrical design of railway track - Horizontal curves, radius, superelevation, cant deficiency, transition curves, safe speed on curves, different types of gradients, grade compensation - worked out problems

Module II (10 hours)
Railway Operation and Control: Points and crossings and their design - Track junctions and simple track layouts - Details of different types of stations and yards - Signaling and interlocking - Control of train movements - Absolute block system - Automatic block system and CTC system.
Railway Construction and Maintenance: Construction of railway track: earthwork, plate laying and packing - Maintenance of trackalignment - gauge, renewal of component parts and drainage, modern methods of track maintenance

Module III (10 hours)
Tunneling: Tunnel alignment and grade - Size and shape of a tunnel - Methods of tunneling in hard rocks - full face method, heading and bench method, drift method - Methods of tunneling in soft soils - compressed air and shield tunneling - Shafts in tunnels - Ventilation of tunnel and various methods - Lining of tunnels - Drainage and lighting of tunnels – Micro Tunneling – trench less technology

Module IV (12 hours)
Airport planning and Design: Introduction - Aircraft characteristics and their influence on planning of airports - Airport obstructions and zoning - Component parts of airport and site selection - Runway design - Orientation, basic runway length, corrections and geometric design - Design of taxiways and aprons - Terminal area planning - Facilities in terminal area and their planning concepts, aircraft parking configurations - Airport drainage system - surface and subsurface drainage systems and their design

References
2. Agarwal M.M., Railway Engineering, Prabha and Co
List of Exercises

1. Tension test on MS rod
2. Shear Test on MS rod
3. Torsion test on MS Specimen
4. Bending test on steel beams
5. Spring test – open and close coil springs
6. Workability tests – slump, compaction, V-bee, flow and preparation of cubes
7. Compression test on cubes and cylinders – determination of modulus of elasticity
8. Split test on concrete cylinders and flexure test on concrete
9. Study of extensometers and strain gauges
MEG391 FLUIDS LABORATORY

List of Exercises

1. Study of instruments: Pressure gauge, Piezometer, Manometer, Pressure transducers, Pilot tubes
2. Demonstration of Bernoulli’s theorem
3. Determination of friction factor for various types of pipes
4. Orifices and mouth pieces
5. Notches and Weirs
6. Discharge measurements – Venturimeter, Venturiflume, Orifice meter and Water meter
7. Open channel flow – Determination of Manning’s co-efficient
8. Tracing back water Profiles
9. Tracing draw down profiles
10. Hydraulic Jump Parameters