CE 103: ENGINEERING GRAPHICS

L: T: P (0-0-3)

Credits- 2

Note: All drawing exercises should be performed on AutoCAD.

Unit – I: Engineering Drawing and its importance: Types of lines and their meaning in context to Engineering Drawing: Dimensioning and various method of dimensioning.

Various types of projections: First and Third angle systems of orthographic projections; Projection of Points in different quadrants.

Unit – II: Projections of Straight Lines – Parallel to one or both reference planes; Contained by one or both planes; Perpendicular to one of the planes; Inclined to one plane but parallel to the other planes; Inclined to both the planes; True length of a line and its inclination with reference planes; Traces of a line.

Unit – III: Projections of Planes – parallel to one reference plane; Inclined to one plane but perpendicular to the other; Inclined to both reference planes.

Unit – IV: Projections of Polyhedra Solids and Solids of Revolution - in simple positions with axis perpendicular to a plane; With axis parallel to both planes; With axis parallel to one plane and inclined to the other; Projections of sections of Prisms; Pyramids; Cylinders and Cones: True shape of section.

Unit – V: Development of surface of various simple solids such as cubes; Cylinders; Prisms; Pyramids etc. and their Orthographic views. Intersection of solids.

Unit – VI:Isometric projections - Introduction; Isometric scale; Isometric views of plane figures; Prisms; Pyramids and Cylinders.

Recommended Books:

1. Engineering Graphics with AutoCAD; D. M. Kulkarni; A. P. Rastogi; A. K. Sarkar; PHI Learning Private Ltd.
2. Engineering Graphics using AutoCAD; T. Jeyapoovan; Vikas Publishing House.
3. Introduction to Engineering Drawing; N. D. Bhatt; Charotar Publishing House.
4. Machine Drawing with AutoCAD; Pohit; Pearson Education.
5. Engineering Graphics with AUTOCAD; James D. Bethune; Prentice Hall.
6. AutoCAD Tutor for Engineering Graphics; Alan Kalameja; Autodesk Pr.

(Batch 2014 onwards)

CE 202: BUILDING MATERIAL AND CONSTRUCTION

L: T: P (3-0-0) **Credits- 3**

UNIT I: **Bricks** and its properties, Bricks: - Brick Clay, Preparation of Bricks, Dimensions of brick, Classification of bricks as per IS 1077-1985, Testing of bricks; Characteristics of good brick **Stones:** Classification of rocks, test for stones, characteristics of a good building stone, deterioration of stones, common building stones of India, comparison of the brick comparison, of the brick work and stone work.

UNIT II: **Cement**: Hydration of cement, Chemical reaction, Structure of cement paste, Consistency and setting. **Aggregates:** Classification, characteristics, soundness of aggregates, fineness modulus, maximum size of aggregate and grading of aggregates **Lime** and supplementary cementations materials, Classification & Properties, Cement, aggregate and water selection for concrete, **Concrete** as a material, its ingredients and Properties of concrete, water –cement ratio, workability, compressive strength, grades. **Admixtures:** Functions, classification accelerating admixture, retarding admixture, air-containing admixtures, waterproofing and permeability reducing admixture, corrosion inhibiting admixtures and coloring admixture. **Production of Concrete:** Batching, mixing, transporation, placing, compaction and curing of concrete.

UNIT III: **Metals** with reference to Structural **Steel** and others **Aluminium** and its alloys, Copper and its alloys, Zinc and its alloys: Structure and its role in properties of steel. Strengthening mechanism in metals. Behaviour in service and corrosion. Uses of metals in civil engineering.

UNIT IV: **Paints, Distempers and Varnishes**:- Classification of paints, Considerations in choosing paints, Commonly used paints in buildings, Distempers, Paints Primers, Varnishes and its types. **Plastics** and Polymers in construction, Asphalt, Bitumen and Tar as a material, Water proofing and Damp Proofing materials.

UNIT V: **Timber and Glass**: Timber:- Classification of trees and structure of wood, Seasoning of wood, Defects in timber, Classification of timber, Selection of wood for buildings, Testing of wood Glass:- Manufacture and Classification, Treatment of glass, uses of glass, Testing for quality Characteristics and Performance of Glass, Glass Wool.

UNIT VI: **Earthwork** – Soil investigation, Project site development, Setting out, Excavation, Groundwater control, Plants; tools and equipment for earthwork, excavation, transportation of excavated soil and handling.

UNIT V: **Foundations**: Requirements, Shallow foundations, Deep foundations, Types of foundations for different requirements and soil conditions, **Piling – Classification of piles** – Displacement piles, Replacement piles, Pile driving methods.

UNIT VI: **Concreting** – **Formwork** – Shuttering and Scaffolding, Deshuttering, Concrete curing, Inspection and acceptance of finished concrete, Laboratory testing facilities at site, Concrete mixers and pumps, Screening of aggregates, Concrete production equipment.

UNIT VII: **Internal works: Cladding and Wall** – Masonry materials, Masonry bonding, Stone masonary, Solid brickwork and brick bonds, Composite construction, Refractory masonary, Enabling work for cladding, Supervision and approval of completed work, **Lintels**

CE205: Mechanics of Materials

L-T-P: (3-1-0)

Credits: 04

Module 1: Axial stress and strain: Concept of stress and strain, Hooke's law, Stress-strain diagram of ductile and brittle material, statically determinate and indeterminate problems, compound and composite bars, Problems involving temperature changes.

Module 2: Shear Stresses: Shear Stresses in Beams, Shear stress formula for beams, shear stress distribution in beams, Stresses in thin spherical shells; thin cylinders, symmetrically loaded plates with different loading conditions.

Module 3: Theory of pure bending: Derivation of flexural formula for straight beams, bending stress calculation for beams of simple and built up section.

Module 4: Shear force and Bending moment diagrams: Types of load on beam, classification of beams, shear force and bending moment diagrams: simply supported, overhang and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, relationship between load, shear force and bending moment.

Module 5: Deflection of Beams: Governing differential equation for deflection of straight beams having constant flexural rigidity, double integration and Macaulay's methods for slopes and deflection.

Module 6: Torsion of Circular Shafts: Basic assumptions, torsion formula, power transmission by shafts, Deformation and stress concentration in circular shafts, Design of transmission (solid and hollow) shafts based on strength and stiffness, Introduction to Close-coiled Helical Springs, Springs in Series and Parallel, Open-coiled Helical Springs .

Module 7: Analysis of Plane Stress and Strains: Transformation equations for plane stress and plane strain, Mohr's stress circle, Relation between elastic constants, strain measurements, strain rosettes.

Module 8: Columns: Introduction, Euler's Theory, Equivalent Length, Limitations of Euler's Formula, Rankine's Formula, Extension of Euler's Formula to Pin- Ended Columns and Columns with other end conditions.

Module 9: Strain Energy and Theories of Failures: Introduction, strain energy, Shear Strain energy, stresses due to various types of loading, theories of Failures, Graphical Representation of Theories of Failures.

Text Books:

1. Beer, Ferdinand P., Johnston, E.Russel, Dewolf, John F., Mazurek, David F., Mechanics of Materials, Tata McGraw Hill.
2. Timoshenko, S, Strength of Materials, Van Nostrand, New York.

Reference Books:

1. Popov, Egor P., Introduction to Solid Mechanics, Prentice Hall.
2. Srinath, L.S., Advanced Mechanics of Solids, Tata Mc Graw Hill.

CE215: ENGINEERING GEOLOGY

L: T: P (2-0-0) **Credits 2**

Evaluation Scheme

SESSIONAL

- Quiz : 10%
- Presentation : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT I Introduction to earth sciences, elementary idea of internal structure of earth. Knowledge of physical properties of common rock forming minerals. Introduction to major group of rocks, mode of origin, classification and properties.

UNIT II GEOMORPHOLOGY AND STRUCTURAL GEOLOGY: Fundamental concepts of study of landforms. Weathering and soil formation. Elementary idea of geological work of glaciers, river, sea waves and wind and their engineering significance. Deformation of rocks, dip, strike, and structural features including fold, fault, joint and unconformity and their engineering significance.

UNIT III: STRATIGRAPHY AND HYDROGEOLOGY: Geological time scale, fundamental of stratigraphy, physiographics and geotectonic divisions of India, distribution of rocks of different ages in India. Concepts of porosity, permeability, water table and types of aquifers, occurrence and vertical distribution of water in soils and rocks.

UNIT IV: EARTHQUAKES, MASS MOVEMENTS AND SITE INVESTIGATION: Causes, types, intensity and magnitude. Engineering designs and precaution. Landslides, stability of hill slopes and road cuttings. Factors in site selection, alignment and construction of dams, reservoir, bridges and tunnels.

UNIT V: Geotechnical Properties of Rocks and Rock Masses: Rocks as construction materials. Common tests, occurrence and distribution of building stones, road and rail ballast in India. Engineering properties and geomechanical classification of rocks mass.

School of Engineering

Gautam Buddha University

CE-207: Surveying - I

CREDITS: 4 (3-1-0)
CREDITS: (3-1-0) New used 2014

Introduction: This course is aimed to introduce and provide knowledge of various surveying and data collection techniques. Various conventional and advance surveying techniques and surveying equipments suitable for measurement of distance, direction, elevation and coordinates will be discussed in this course.

Aims and Objectives: At the end of this course students are able to-

- Understand different surveying principles and techniques.
- They will be able to finalise and select a particular type of survey and equipment suitable for a particular application.
- Measure distance, direction and elevation using different type of surveying equipments
- They will be able to prepare a surveying map using collected surveying data.
- They will able to use different type of surveying equipment.

Learning Outcomes: At the end of this course students will be able to:

- Measure distance, directions and elevation using different surveying techniques and equipments.

Course Delivery: A mix of instructional methods will be used like lectures, demonstration of equipments and tutorial exercises. Handout and reading references will be provided as and when required.

Evaluation Scheme:

Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weight-age for the different components is as follows:

a.	Quizzes/ Class Tests/ Assignments	20%
b.	Class Participation/ Presentation & Discussion	5%
c.	Mid-term Exam	25%
d.	Term- end Exam	50%

Gautam Buddha University
School of Engineering, Greater Noida, U.P., India

Course code - CE203

Course Name - Fluid Mechanics / Hydraulics (2014 Ba onwa

(Common Course for UG Civil & Mech. Engg., 3rd Sem.)

Duration of Examination 3 Hours
L- T- P
3 - 1- 0

Credits: 4
Maximum Marks: 100

1. Fluid & Fluid Properties: Continuum concept, properties of fluids, Newtonian and Non-Newtonian fluids.

2. Fluid Statics: Pascal's law, hydrostatic pressure, pressure measurement, manometer and micro-manometer, pressure gauge; Forces on plane and curved surfaces, centre of pressure, equilibrium of submerged and floating bodies, buoyancy, metacentric height; Fluids subjected to constant linear acceleration and to constant rotation.

3. Kinematics of Fluid: Types of flow, Lagrangian and Eulerian approach, path line, streak line and stream line, stream tube, stream function and potential function, flownet; Deformation of fluid elements, vorticity and circulation.

4. Fluid Dynamics: Conservation equations of mass, momentum and energy, Navier-Stokes, Euler and Bernoulli equations, Reynolds transport theorem; Forces due to fluid flow over flat plates, curved vanes and in the bends, applications of Bernoulli equation.

5. Flow Measurement: Pitot tubes, venturi meter and orifice meters, orifice, mouthpieces, notches and weirs, rotameter

6. Dimensional Analysis &Similitude: Basic and derived quantities, similitude and dimensional analysis, Rayleigh's method & Buckingham π – theorem, non-dimensional parameters, model testing.

7. In-compressible Flow: Reynolds experiment, laminar and turbulent flow, Darcy equation, plane Poiseuille flow, Couette flow, Hagen-Poiseuille flow; Friction factor and Moody's diagram, flow through pipes, boundary layer, losses in pipes and pipe fittings; Flow over aerofoil, lift and drag, flow separation, Hydraulic & Energy gradient lines.

8. Ideal Fluid Flow: Ideal flow identities, flow over half body, Rankine oval, stationary and rotating cylinders, Magnus effect, D'Alembert's paradox.

Course code – CE209

Course Name - Fluid Mechanics Lab / Hydraulics lab (2014 B
(Common Course for UG Civil & Mech. Engg., 3rd Sem.) 0 4

Duration of Examination 3 Hours

L- T- P

0 - 0 – 3

Credits ~~2~~ 1 Credi

Maximum Marks 50 201

Syllabus & List of Experiments

1. Experiments for Hydrostatics principles on a fluid.
   a. Determination of fluid density and specific gravity.
   b. Capillarity in tubes and between plates.
   c. Measurement of viscosity by falling sphere method.
   d. Verification of Pascal's law.
   e. Verification of Archimedes' principle and demonstration of principles of flotation.
   f. Stability of a floating body and determination of metacentric height.
   g. Measurement of force and centre of pressure on a plane surface
2. Experiments on pressure measurement.
   a. Pressure measurement by Manometer.
   b. Calibration of a Bourdon pressure gauge
3. Experiments to study the flow through a variable area duct and verification of Bernoulli's energy equation.
4. Experiment for :
   a. Determination of viscosity of fluids.
   b. Determination of drag coefficient of various particles of spares.
5. Experiments for determination of coefficient of velocity & discharge for an orifice.
6. Experiments to determine the discharge coefficient for a Vee and rectangular notch.
7. Experiments on Flowmeter :
   a. To determine the coefficient of discharge and coefficient of discharge for an obstruction flow meter namely orifice meter.
   b. To determine the velocity distribution for pipeline flow with a pitot static probe.
8. Experiments to determine coefficient of discharge for an obstruction flow meter e.g. venturi meter.
9. Experiment for causes & effects of Cavitation and working of Venturi meter.
10. Experiments to determine the friction coefficients and head losses for pipes of different materials and diameters with real time computer control.
11. Experiments to determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ elbows/ fittings / bend.
12. Experiments to study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
13. Experiments to study boundary layer theory thorough Hydrogen Bubble based Flow Visualization phenomenon.
    c. Understanding laminar and turbulent flow
    d. Visualization of boundary layer growth & separation and eddy formation
    e. Observation of flow around standard shapes (cylinder, aerofoil etc)
    f. Observation of flow around user created models.

CE313: CONCRETE LAB

CREDITS: 02

L-T-P: 0-0-3

1. Cement
    1. Normal Consistency of cement.
    2. Initial & final setting time of cement
    3. Compressive strength of cement
    4. Fineness of cement by Blaine air permeability test.
    5. Soundness of cement by Le-chatalier's apparatus.
    6. Tensile strength
2. Coarse Aggregate
    1. Crushing value of aggregate
    2. Impact value of aggregate
    3. Water absorption of aggregate
    4. Sieve Analysis of Aggregate
    5. Specific gravity & bulk density
    6. Grading of aggregates.
3. Fine Aggregate
    1. Sieve analysis of sand
    2. Silt content of sand
    3. Bulking of sand
4. Bricks:
    1. Water absorption.
    2. Dimension Tolerances
    3. Compressive strength
    4. Efflorescence
5. Concrete:
    1. Design of a concrete mix in accordance with IS and ACI guidelines.
    2. Measurement of Workability to concrete using
        (1) Vee-Bee Consistometer test
        (2) Slump test
        (3) Flow test
    3. Determination of compressive strength of concrete cubes and cylinders for different concrete mixes.
    4. Determination of flexural strength of concrete.
    5. Determination of split tensile strength of concrete.
    6. Destructive and non destructive testing on concrete

CE 211: MATERIAL TESTING LAB

L-T-P: 0-0-2 Credits: 01

List of Experiments:

1. To Determine the Hardness of the Specimen of Steel/ Soft Metal obtaining
    a) Rockwell Hardness Number
    b) Brinell Hardness Number
    c) Vicker Hardness Number
2. To Determine the stiffness constant of spring (metal) on spring testing machine.
3. To Determine the Impact Strength of M.S. / C.I. Specimen on Izod Impact Testing Machine and Charpy Impact Testing Machine.
4. To Determine the Modulus of Rigidity of M.S. / C.I. Bar on Torsion Testing Machine (Destructive Test).
5. To Determine the Modulus of Rigidity of Brass Bar on Torsion Testing Machine (Non-destructive).
6. Verification of Bending moment and shear force.
7. Analysis of perfect truss.
8. Analysis of redundant truss.
9. Determination of modulus of elasticity of a mild steel.

School of Engineering

Gautam Buddha University

CE: 213 - Surveying Laboratory-I Credit: 2 (0-0-3)

Introduction: This course is aimed to introduce and provide knowledge of various surveying techniques and equipments can be used for surveying i.e., measurement of distance, direction and elevation. Various conventional and advance surveying equipments will be demonstrated and practiced in field.

Aims and Objectives: At the end of this course students are able to-

- Understand working of different type of surveying equipments.
- They will be able to use surveying equipments in field for measurement of distance, direction and elevation.
- Use surveying data for preparation of maps.

Learning Outcomes: At the end of this course students will be able to:

- They will be able to use surveying equipments in field for measurement of distance, direction and elevation.

Course Delivery: A mix demonstrations and field exercises. Handout and reading references will be provided as and when required.

Evaluation Scheme:

Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weight-age for the different components is as follows:

a.	Field exercises and laboratory assignments	30%
b.	Class Participation & Discussion	5%
c.	Presentation of laboratory exercises/quiz	15%
d.	Term- end laboratory examination	50%

CE433/CE307: ENGINEERING HYDROLOGY

Credits 4

L: T: P (3-1-0)

Objective: Students are expected to realize the importance of water resources and its application in engineering

Evaluation Scheme

TA

- Quizes : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

Unit - I

Precipitation: Definition, Hydrologic cycle, Water balance, Types & forms of precipitation, Measurement of precipitation, Adequacy of rain gauges, Analysis of missing data, consistency of rainfall record, Average rainfall, Computation of Frequency analysis.

Unit-II

Evaporation: Definition, Evaporation process, and its estimation, Transpiration, Evapotranspiration, measurement of evapotranspiration – Penman, Thornwaite and Balney-Criddle methods, Evaporation control, Infiltration, Infiltration process, factors affecting infiltration, measurement of infiltration, infiltration indices.

Unit-III

Measurement and Analysis: Stream Gauging, measurement of stage, velocity, Direct and Indirect methods of stream flow measurement, Rating curve, Stage discharge relationship, Surface Runoff, Factors affecting runoff, Rainfall - runoff relationships, empirical equations. Flow duration curves. Mass curves and its applications.

Unit- IV

Hydrographs: Hydrographs, factors affecting hydrograph, base flow separation, Unit Hydrograph, Derivation of unit hydrograph for single & complex storms, Unit hydrograph of different durations synthetic unit hydrograph.

School of Engineering

CE 431/CE 204: ENVIRONMENTAL ENGINEERING – I

Credits 4 : L- T- P (3-1-0) **Maximum Marks 100**

Aim: To provide detailed understanding regarding usage of water for drinking purpose – from identification of source, planning the treatment systems, distribution of treated water with development of distribution of layout and necessity of maintenance.

Evaluation Scheme

TA

Qiuzzes	:	10%
Assignments	:	10%
Class Participations	:	5%

Examination

Mid Term	:	25%
End Term	:	50%

(60 Sessions each of 60 minutes : 45 Lectures + 15 Tutorials)

Unit - I

Water Demand and Supply: Types of demand, population forecasting, different sources for water supply, design period, estimation of water demand for various uses, factors affecting consumption and fluctuation of demand.

Unit II

Water Quality Parameters and Criteria: Physical chemical and microbiological water quality parameters and their significance. Impurities – types and their effects, sampling & analysis, water borne diseases and their control, water quality standard – potable and industrial.

Unit -III

Water Supply Systems: Sources, Pumping, Intake, Intake Structure- site selection, Transmission, Different types of reservoirs, Surface and subsurface water source – types and selection, Planning and Components, Distribution System: Requirements, Classification, Layout and Design, Analysis, Distribution Pipe – types, selection, laying, jointing, testing.

Unit -IV

Water Treatment Systems: Water treatment: sedimentation, coagulation, types of coagulants and coagulant aids, and flocculation, Filtration- slow sand & rapid sand, pressure filters, Disinfection- different types, chlorination, Advanced Methods for water treatment: water softening, chemical precipitation, ion exchange, reverse osmosis.

Unit -V

Operation and Maintenance of Water Treatment Systems: Objectives of Operation and Maintenance, Record System, Checks to be carried out in Transmission System, Causes of Failure in Pipeline, Operation and Maintenance of Water Treatment Plant.

Unit-VI

Water Efficiency: Tools and Techniques: Water Metering, Level Measurement, Pressure Measurement, Telemetry and Scada Systems, Management Information System (MIS), Water Audit, Water Losses and controls, Monitoring Leakage & control and its Benefits.

Suggested books

Text Books:

1. Steel E. and W. McGhee; Water Supply and Sewerage, McGraw-Hill publications, 1991.
2. Birdie & Birdie; Water Supply and Sanitation Engineering, Dhanpat Rai Publications, Ninth edition, 2011.

Reference Books:

1. Peavy & Rove; Environmental Engineering. McGraw Hill Publications, 2000.
2. Sawyer & McCarty, Environmental Chemistry, McGraw Hill Publications, 5th edition, 2002.
3. Manual on Operation and Maintenance of Water Supply Systems by Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development, New Delhi

CE206 **Structural Analysis – I** L-T-P: 3-1-0

Module 1: Introduction - Forms of structure, idealization, elastic and linear behavior, equations of equilibrium, free body diagrams, principle of superposition, relations between load, shear and bending moments.

Module 2: Analysis of Determinate Structures: Displacements

i. Geometric Methods: Deflected shapes, moment-area method, and conjugate-beam method.
ii. Energy Methods: Strain energy in members, Betti's and Maxwell's Laws of reciprocal deflections, Concept of Virtual work and its applications, Castigliano's theorems, unit load method, deflections of trusses and 2D-frames.
iii. Arches: Linear Arch, Eddy's Theorem, Analysis of three hinged arches, Shear force & bending moment diagram and temperature effects.

Module 3: Indeterminate Structures: Introduction, static and kinematic indeterminacies, stability of structures, internal forces in two and three-dimensional structures; **Analysis of Indeterminate Beams and Frames:**

i. **Classical Methods:** Methods of consistent deformation, method of least work, and theorem of three moments.
ii. **Conventional methods of Analysis of rigid frames:** Slope deflection method, moment distribution method.
iii. **Approximate methods:** Portal method, and Cantilever method.

Module 4: Moving Loads and Influence Line Diagrams: Bending moment and shear force diagrams due to single and multiple concentrated rolling loads, uniformly distributed moving loads, equivalent UDL, Muller Breslau principle: Influence lines for beams (Simply supported beams, cantilever beams, overhanging beams, double overhanging beams), girders with floor beams and frames calculations of the maximum and absolute maximum, shear force and bending moment envelopes. **Indeterminate Structures:** Influence lines for bending moment, shear force and reactions for continuous, balanced cantilever beams and rigid frames using elastic theorems.

Text books:

1. Hibbler, R.C., Structural Analysis, Pearson Education, 2006.

Reference Books:

1. Vazirani, V.N., Ratwani, M.M., Analysis of structures Vol I & II, Khanna Publishers 17th edition, 2011.
2. Bhavikatti, S.S., Vol I & II, VIkas Publishing House Pvt. Ltd., Third Reprint 2009.
3. Reddy, C.S., Basic Structural Analysis, Tata Mc. Graw Hill, New Delhi, 2007.
4. Menon, D., Advanced Structural Anlaysis, Narosa Publishiong House, 2009.

School of Engineering
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CE-208: Surveying - II **CREDITS: 4 (3-1-0)**

Introduction: This course is aimed to enhance the surveying knowledge of the students using advance instruments. Various advanced surveying techniques and surveying equipment suitable for measurement of relative locations (horizontal & vertical) will be discussed in this course.

Learning Outcomes: Upon successful completion of this course including individual Lab session, students should be able to:

- Competently book and reduce field observations.
- Observe a traverse using a Total Station.
- Understand and appreciate the errors in traversing.
- Understand the theory of error propagation.
- Differentiate between random, systematic and gross errors.
- Carry out, process and plot a topographic survey making use of a variety of field equipment
- Appreciate the accuracy of different positioning methods.
- Discuss the different positioning methods available using GNSS.
- Create, adjust and analyse a GNSS survey control network.
- Discuss the capabilities and accuracies of terrestrial laser scanners.
- Understand the use of aerial photographs and high resolution images for mapping.

Course Delivery: A mix of instructional methods will be used like lectures, demonstration of equipment and tutorial exercises. Handout and reading references will be provided as and wherever required.

Evaluation Scheme:

Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weight age for the different components is as follows:

a.	Quizzes/ Class Tests/ Assignments	20%
b.	Class Participation/ Presentation & Discussion	5%
c.	Mid-term Exam	25%
d.	Term- end Exam	50%

75

CE421 - ESTIMATION AND COSTING

L: T: P (2: 0: 0) Credit- 03

Objective:
This subject covers the various aspects of estimating of quantities of items of works involved in buildings, water supply and sanitary works, road works and irrigation works. This also covers the rate analysis, valuation of properties and preparation of reports for estimation of various items. At the end of this course the student shall be able to estimate the material quantities, prepare a bill of quantities, make specifications and prepare tender documents. Student should also be able to prepare value estimates.

Unit 1: Introduction & Estimate of Buildings
Types of estimates, Units of measurements, Methods of estimates, Advantages, Load bearing and framed structures, Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof, Various types of arches, Calculation of brick work and RCC works in arches, Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

Unit 2: Estimate of Other Structures
Estimating of septic tank, soak pit, sanitary and water supply installations, water supply pipe line, sewer line, tube well, open well, estimate of bituminous and cement concrete roads, estimate of retaining walls, culverts, estimating of irrigation works, aqueduct, syphon, fall.

Unit 3: Specification
Data: Schedule of rates, Analysis of rates, Specifications, sources, Detailed and general specifications, Arbitration and legal requirements.

Unit 4: Valuation
Necessity, Basics of value engineering, Capitalized value, Depreciation, Escalation, Value of building. Calculation of Standard rent, Mortgage, Lease

Unit 5: Report Preparation
Principles for report preparation, report on estimate of residential building, Culvert, Roads, Water supply and sanitary installations, Tube wells, Open wells.

TEXT BOOKS:
1. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt.
Ltd., 20032.
2. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand &
Company Ltd., 2004

School of Engineering

106

CE435/CE210 : ENVIRONMENTAL ENGINEERING LAB – I

Credits 2 : L:T:P (0-0-3) **Maximum Marks 100**

Introduction: This course is aimed to provide detailed practical knowledge and understanding regarding quality criteria usage of water for drinking purpose – from identification of source, planning the treatment systems, distribution of treated water and identifying the problems in water distribution systems

Aims and Objectives: At the end of this course students are able to-

- Get an understanding of basic drinking water quality parameters (physical, Chemical and Biological) used in water supply, treatment and distribution systems.
- Analysis of these parameters will help them to get an understanding of problems such as contamination and pollution associated with quality of drinking water and comparing them with International as well as National Standards

Learning Outcomes: At the end of this course the students will be able to:

- Learn the different methods of water quality analysis for different physical, biological and chemical parameters
- Get an understanding of applicability of water quality analysis and data interpretation in the lab as well as in the field also

Course Delivery: A number of practical exercises for water quality analysis for different parameters will be taught to students and handouts for the same with reading references will be provided as and when required.

Evaluation Scheme: Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weightage for the different components is as follows:

a. Laboratory Assignments 30%
b. Class Participation & Discussion 5%

212 – Surveying Laboratory – II

Credits:2 (0-0-3)

uation Scheme:

inuous evaluation will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weight-age for the different components is as follows:

a) Survey Camp 30%
b) Field Exercise and Laboratory Assignments 20%
c) End Term Evaluation 50%(30 written and 20 viva voce examination)

Laboratory Exercises:

1. Measurement of distance using Laser distance meter, EDM
2. Traversing using Total Station
3. Transverse computation and adjustment
4. Precise leveling using Auto Level
5. Precise leveling using Digital Level
6. Introduction to terrestrial laser scanning.
7. Study of various components of GPS and field planning
8. Measurement of positioning using GPS
9. Traversing using GPS
10. Survey camp (two days equivalent to 4 labs)

    Prepare a detailed site map by using any of the surveying method (compass surveying, chain, theodolite, total station etc.)

CE303: TRANSPORTATION ENGINEERING - I

Credits 3

L: T: P (3-0-0)

Objective: Students are expected to know about the importance and basic concepts of highway engineering.

Evaluation Scheme

- Sessional : 25%
- Mid Term : 25%
- End Term : 50%

Module 1: General: Introduction, Different modes of transport, Development of Transport System, Phased development of Roads in India, Planning & Management of Highways, Classification of Roads, National Transport Policies.

Module 2: Geometric Design of Highways: Introduction, Highways Cross-section Elements, Sight Distances, Design of Horizontal alignment, Design of vertical Alignment.

Module 3: Highway Materials & Construction: Bituminous materials, Bituminous Paving Mixes, binder and properties: Manufacturing of bitumen, comparison between bitumen and tar, cut back, emulsion. General Construction, Earthwork, Construction of earth, gravel and water bound macadam roads, cement concrete pavements, joints in cement concrete pavements.

Module 4: Highway Pavements: Types of pavements, Design Factors, Design of flexible pavements by G.I. & CBR methods, Design of rigid pavements. Failures of flexible and rigid pavements: Maintenance of pavement evaluation and its strengthening.

Module 5: Traffic Engineering: Road user characteristics, Importance of traffic studies, spot speed, speed and delay and origin and destination studies. Vehicular flow models, Stream variables: Spacing and concentration, headway and flow, mean speed, Time distance diagram of flow, Experimental data and model parameters, model calibration.

Module 6: Highway Drainage: Introduction, Importance & Principles, Design of Surface Drainage and Sub Surface drainage, Drainage of slopes & Erosion Control, Road Construction in Water-logged Areas..

Module 7: Highway Maintenance: Introduction, Maintenance of Earth, gravel, WBM Roads, Bituminous Roads, Cement Concrete pavements, Maintenance of berms.

CE301: R. C. STRUCTURE – I

Credits 4

L: T: P (3-1-0)

Objective: Students are expected to know the different aspects of the behavior of reinforced concrete members. Design in reinforced concrete implies an understanding of the behavior of plain concrete and reinforced concrete.

Evaluation Scheme

TA

- Quizes : 10%
- Assignments : 10%
- Class Participatiqns : 5%

Examination

- Mid Term : 25%
- End Term : 50%

Module 1: Introduction: Reinforced concrete, definition, properties of materials, grades of concrete and reinforcing steel, stress-strain curves, permissible stresses, concrete structural systems-slabs, beams, columns and foundations, working stress design, ultimate strength and limit state design method.

Module 2: Introduction to Working Stress Design Method: Assumptions, problems on computation of moment of resistance, determination of stresses, and design of rectangular beams reinforced in tension and compression. Design procedure for shear reinforcement, bond and development length, anchoring and curtailment of bars.

Module 3: Limit State Design Method: Introduction, Limit States, Characteristic values, characteristic strength, characteristic loads, design values for materials and loads, factored loads.

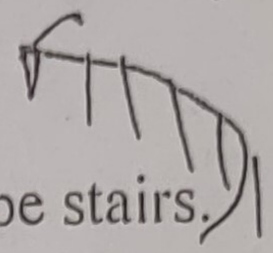
Limit State of Collapse (Flexure) Types of failures, assumptions for analysis and design of singly reinforced, doubly reinforced sections, and flanged beam sections.

Limit State of Collapse (Shear, bond and torsion) Introduction - Design for shear, structural components subjected to torsion, design of rectangular beam section for torsion, development length. continuation of reinforcement (beyond cut off points).

Limit State of Serviceability Deflection, effective span to effective depth ratio, modification factors for singly reinforced, doubly reinforcement and flanged beams, crack formation and its control.

Limit State Design of Columns - Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement

Module 4: Limit State Design of Slabs: One-way slabs and two-way rectangular slabs, Continuous slab.



Module 5: Design of staircase and Design of tread-riser type stairs.

Note: Application of SP 16, Detailing of Reinforcement - SP: 34, Codal Provision for RC Elements as per IS 456:2000

Text Books

1. Pillai S. U. & Menon D., "Reinforced Concrete Design," Tata Mc-Graw Hill.
2. Jain O. P. & Krishna J., "Plain and Reinforced Concrete Vol. I & II," NemChand & Bros.

References

1. Gambhir M.L., "Fundamentals of Reinforced Concrete Design," PHI.
2. Bhavikatti S. S., "Design of R.C.C. Structural Elements Vol 1," New Age International Publishers.
3. Punmia B.C., Jain A.K., "R.C.C. Designs," Laxmi Publications (P) Ltd.
4. Dayaratnam P., "Reinforced Concrete Design," Oxford & IBH.

CE304: SOIL MECHANICS

L: T: P (3-1-0) **Credits 4**

Evaluation Scheme

TA

- Quizes : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1 INTRODUCTION: Soil formation, classification, characteristics and properties of various soils. **INDEX AND CLASSIFICATION PROPERTIES OF SOILS:** Index properties, sieve & hydrometer analysis, Atterberg's limits, sensitivity, thixotropy, and plasticity charts, Indian standard, AASHTO

UNIT II SEEPAGE AND PERMEABILITY: Darcy's law, validity of Darcy's Law, seepage velocity, factors affecting permeability, Laboratory and field determination of permeability. Flow net and its properties, Laplace equation, methods of drawing flow net, seepage through earth dams, phreatic lines, exit gradient and seepage pressures, phenomenon of piping and heaving, filters. Anisotropy, Permeability of layered soils. **EFFECTIVE STRESS PRINCIPLE** Capillarity, types of head, seepage forces, quick sand condition, and critical hydraulic gradient.

UNIT III COMPACTION: Compaction tests, OMC, factors affecting compaction, control of compaction, field compaction equipment and their suitability.

UNIT IV COMPRESSIBILITY AND CONSOLIDATION: Terzaghi's theory, time rate of consolidation, consolidation test, Compressibility & Coefficient of Consolidation, NC, OC soils, determination of pre-consolidation pressure, settlement analysis, secondary consolidation.

UNIT V SHEAR STRENGTH: Definition, Mohr's stress circle, Mohr-Columb strength theory, direct, triaxial, unconfined and vane shear tests. Drainage conditions, shear characteristics of normally consolidated, over consolidated clays and dense and loose sands, Dilatancy.

CE309 **Structural Analysis – II** L-T-P: 3-1-0

Module 1: Analysis of Two hinged arches, Cables and Suspension Bridges: Analysis of two hinged parabolic and circular arch, Shear force and bending moment, temperature effects, Moving loads on two hinged arches, General cable theorem, shape, elastic stretch of cable, maximum tension in cable and back-stays, pressure on supporting towers, suspension bridges, three hinged and two hinged stiffening girders. Lectures: 10

Module 2: Introduction to systems approach: Force and Displacement methods

Matrix Force Method: Introduction to flexibility approach, Choice of redundant, static equilibrium matrix, deformation compatibility matrix, member flexibility matrix, static equilibrium and deformation compatibility checks. Application to trusses, continuous beams and rigid frames. Lectures: 10

Module 3: The matrix displacement or Stiffness Method: Conditions of stress-strain relationships, equilibrium and compatibility: (a) Structures with axial force members – trusses; (b) Structures with flexural members - continuous beams and rigid frames. **Formulation of various matrices:** Static equilibrium matrix - deformation compatibility matrix, member stiffness matrix, global stiffness matrix, external load matrix, static equilibrium and deformation, compatibility checks and effects of support settlement and lack of fit. Conversion of member loads into joint loads and partitioning of global stiffness matrix. Lectures: 10

Direct Stiffness Method: Derivation of global matrix from energy considerations, transformation matrices, member stiffness matrix with respect to member coordinate system, member stiffness matrix for global coordinates and global stiffness matrix. Displacement boundary conditions, computer generation of global stiffness matrix, effect of temperature and lack of fit. Comparison between stiffness and flexibility method. Lectures: 6

Module 4: Plastic Analysis: Plastic theory, plastic hinge concept, plastic modulus, shape factor, collapse load, basic theorems for finding collapse load, Methods of plastic analysis with application to beams and frames. Lectures: 9

Text books:

1. Weaver, J.M. & Gere, W., Matrix Analysis of Framed Structures, Van Nostrand Reinhold, New York, 1990.
2. Selvam, V.K., Fundamentals of Limit Analysis of Structures, Dhanpat Rai Publications.

Reference Books:

1. Thandavamoorthy, T.S., Structural Analysis, Oxford Publisher, 2011.
2. Vazirani, V.N., Ratwani, M.M., Analysis of structures Vol I & II, Khanna Publishers, 17th edition, 2011.

School of Engineering

Course Name: Advance Environmental Engineering **L:T:P (3-1-0) Credits- 4**

Course Code: CE506/CE432 / CE 504

Course Objectives:

- To expose students about the advancement in the area of waste treatment – with emphasis on domestic liquid wastes – its treatment and disposal at Industrial level to community level - rural and urban.
- On completion of the course, the student is expected to know about the design principles and advancement involved in treatment of waste water.

Course Delivery:

A mix of instructional methods like lectures, demonstration of equipments, and tutorial exercises will be used. Handouts and reading references will be provided as and whenever required.

Evaluation Scheme

1. Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weightage for different components is as follows:

- Qiuzzes/Class test/Assignments : 20%
- Class Participation/Presentation & Discussion : 5%
- Mid Term Exam : 25%
- End Term Exam : 50%

Session Plan (45 Lectures + 15 Session of Tutorials, each of 60 minutes)

Module -I: Conventional water and **waste water treatment methods**, their capabilities and limitations, Need for advanced treatment of water and waste water, Advanced water treatment- Iron and manganese removal, colour and odour removal, Activated carbon treatment, chlorination of waste water, Pure oxygen systems, Multistage treatment systems

Module- II: Methods for the removal of heavy metals, oil and refractory organics, Flotation: Objective, Types of flotation systems, Design considerations, Chemical precipitation for removal of phosphorous, heavy metals and dissolved inorganic substances, Gas transfer: Aeration systems

Module- III: Advanced waste water treatment- Carbonate balance for corrosion control and modern methods and fluoride removal, Membrane filtration: Terminology, Process classification,

Membrane configurations, Membrane operation for micro filtration, Ultra filtration, Ion exchange and Reverse osmosis, Area requirement, Membrane fouling and its control, Application of membranes.

Module- IV: Microbial growth kinetics, Modeling suspended and attached growth treatment processes. Suspended growth processes for biological nitrification and denitrification, Nutrient control in effluents, Nitrogen and phosphorus removal methods including biological methods Anaerobic sludge blanket processes, Design considerations for Upflow Anaerobic Sludge Blanket process (process options, components influence process design).

Module- V: Wetland and aquatic treatment systems; Types, application, Treatment kinetics and effluent variability in constructed wetlands and aquatic systems, Design procedures for constructed wetlands, Management of constructed wetlands and aquatic systems.

TEXT BOOKS :

1. Wastewater Engineering, Treatment and Reuse, Metcalf & Eddy by Inc. 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Biological Processes Design for wastewaters by Benefield, L.D. and Randall C.W., Prentice-Hall, Inc. Eaglewood Cliffs, 1982.
3. Biological wastewater treatment: Theory and Applications by Grady Jr. C.P.L and Lin H.C. Marcel Dekker, Inc New York, 1980.

Reference Books:

1. Environmental Engineering by H.S. Peavy, D.R. Rowe and George Tchobanoglous, McGraw- Hill Company, New Delhi, 1995.
2. Industrial Water Pollution Control by Eckenfelder, W. W., Mc, Graw-Hill, 1999.
3. Wastewater Treatment for Pollution Control by Arceivala, S.J., McGraw-Hill, 1998.
4. Industrial waste treatment Handbook by Frank Woodard, Butterworth Heinemann, New Delhi, 2001.

CE315: TRANSPORTATION LAB

L-T-P:0-0-3 CREDITS:02/1

1. Crushing Value Test of Aggregate
2. Impact Value Test of Aggregate
3. Los Angeles Abrasion Value of Aggregate
4. Shape Test (Flakiness Index, Elongation Index) of Aggregate
5. Flash & Fire Point Test of Bituminous Sample by Martens Apparatus
6. Penetration Test of Bituminous Sample by Universal Penetrometer
7. Stability test of Bitumen using Marshall Apparatus
8. CBR test
9. Softening Point Test of Bituminous Sample by Ring and Ball Apparatus
10. Ductility Test of Bituminous Sample by ductility testing machine
11. Deflection of flexible pavements by moving loads using Benkelman Beam Apparatus

CE312: SOIL MECHANICS LAB

L-T-P:0-0-3 **CREDITS:02**

L-T-P : 0-0-2 sqp

Evaluation Scheme

- Sessionals : 50%
  - Quiz (10)
  - Lab File (20)
  - Mid Term Viva (10)
  - Lab Performance (10)
- End Term : 50%
  - Written Exam (30)
  - Final Viva (20)

Sr No.	Instrument	Name of the test
1.	**Sieve Analysis**	**Grain Size distribution of coarse grained soils.**
2	Hydrometer Apparatus	Garin Size distribution of fine grained soils.
3	Pycnometer	Determination of specific gravity
4	Casagrande apparatus	Determination of Liquid limit and plastic limit of soil.
5	Constant Head Permeability Apparatus	Determining the permeability of soil (coarse sand).
6	Standard Proctor Compaction Apparatus	Determining water content by dry density relation
7	Modified Proctor Compaction	Determining water content dry density relation.
8	Sand Pouring Cylinder and core cutter	Sand replacement method for insitu density and determination of natural or compacted fine grained soils
9	Direct Shear Test	Shear strength parameters of coarse grained soils.
10	Triaxial Shear Test	Shear strength parameters of soils.
11	Vane Shear Test	Undrained shear strength of fine grained soils
12	Consolidometer Test	Determination of C_c and C_v of saturated soils

CE306: Transportation Engineering – II

L: T: P (3-0-0) **Credits- 3**

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1 RAILWAYS: Role of railways in transportation, historical development of railways, permanent way, gauges in railway tracks, typical railway track cross-section, coning of wheels, Function of rails, requirement of rails, types of rail sections **SLEEPERS**: Functions and requirements of sleepers, classification of sleepers, timber, metal and concrete sleeper. **BALLAST**: Function and requirements of ballast, types, comparison of ballast materials.

UNIT II GEOMETRIC DESIGN: alignment, horizontal curves, super elevation, equilibrium, cant and cant deficiency, length of transition curve, gradients and grade compensation. Stations and yards, and their classification. **POINTS AND CROSSINGS**: introduction, necessity of points and crossings, turnouts, points and crossings, design of a simple turnout. **TRACK RECORDING**: Equipment, Mechanized Maintenance, Track Recording & track Tolerances.

UNIT III SIGNALING AND INTERLOCKING: objects of signaling, engineering principle of signaling, classification of signaling, control of train movements, interlocking definition, necessity and function of interlocking, methods of interlocking, mechanical devices for inter locking. Traction and tractive resistance, stresses in track, modernization of railway track.

UNIT IV AIRPORT ENGINEERING: Introduction, site selection, characteristics of airport, Classifications of obstructions, Imaginary surfaces, Approach zone and turning zone. Design of Runway.

UNIT V RUNWAY & TAXIWAY DESIGN: Orientation and Geometric design of runway, airport capacity, geometric design standards for taxiway holding aprons, Wind-rose diagram, Structural design of runway pavements LCN/PCN method of rigid pavement design, Pavement Evaluation for runway & taxiway, design of overlay, Trend growth of Domestic Air Traffic in India, typical airport layouts.

Text Books

1. Arora and Saxena, Railway Engineering , Dhanpat Rai Publications (P) Ltd, New Delhi. (2006).

CE302: R.C. Structure - II

Credits 4

L: T: P (3-1-0)

Evaluation Scheme

TA

- Quizes : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1 FLATS SLABS: Design of flat Slabs, Direct Design Method, Equivalent frame analysis of flat slabs.

UNIT II DESIGN OF ISOLATED FOOTING AND COMBINED FOOTINGS: Different types, design of rectangular, trapezoidal, strap and raft footings. **RETAINING WALLS:** Types, behaviour, stability requirements, design of cantilever and counterfort type retaining walls.

UNIT III WATER TANKS: Introduction, general design requirements on no crack basis, circular and rectangular tanks resting on ground, Overhead tanks, Intze type tanks and their design including staging and foundation.

UNIT IV Continuous beams and building frames, Analysis and Design.

UNIT V Introduction to bridge engineering, investigation fro bridges, IRC loading, Design of slab culvert.

Text Books:

1. Jain, A.K., Reinforced Concrete-Limit State Design, Nem Chand & Bros (1999).
2. Varghese, P. C., Limit State Design of Reinforced Concrete, PHI Publishers (2002).

Reference Books:

1. Jain, O.P., "Plain and Reinforced concrete Vol II".
2. S.K. Mallik and A.P. Gupta, "Reinforced concrete design", Oxford and IBH (1999).
3. S.N. Sinha, "Reinforced concrete design", Tata McGraw Hill (2000)
4. S.U. Pillai and D. Menon, "Reinforced concrete Design", Tata McGraw Hill (1999).
5. R. Park and T. Paulay, "Reinforced Concrete Structures", John Wiley and Sons, (1975)
6. C. E. Reynolds, "Reinforced Concrete Designers Hand Book", E&FN Spon, (1999).
7. Winter, G., "Design of Concrete Structures," Mc Graw Hill, Toxyo, Japan.

CE310: Design of Steel Structures

L: T: P (3-1-0) **Credits 4**

Evaluation Scheme

TA

- Quizes : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT I INTRODUCTION: Introduction to WSM and LSM, Loads, structural steels and their specifications, structural elements, design specifications as per IS: 800-2007. **CONNECTION:** Riveting and bolting, their types, failure of riveted joint, efficiency of a joint, design of riveted joint, concentric riveted and bolted joints, Types of welded joints, design of welded joint subjected to axial loads, welded joints subjected to eccentric loads, simple, semi-rigid and rigid connections.

UNIT II COMPRESSION & TENSION MEMBERS: Axially loaded columns, effective length, slenderness ratio, allowable stresses, design of axially loaded members, laced and battened columns and their design, eccentrically loaded columns, column splice, encased columns. Types of tension members, net area, net effective area for angles, tees, tension splice, and lug angles.

UNIT III FLEXURAL MEMBERS (BEAMS): Design criteria, permissible stresses, laterally supported beams and their design laterally unsupported beams, web buckling, web crippling, plate girders, encased beams, members subjected to bending and compression, slab base, gusseted base, grillage foundation.

UNIT IV INDUSTRIAL BUILDINGS: Design of Roof Truss: Load combinations. Design of Purlins, Bracings and gantry girders.

Text Books

1. Subramanian N.: Design of Steel Structures, Oxford University Press (2008)..

Reference Books

1. Ajmani. A. L. and Arya. A. S.. Design of Steel Structures, Nem Chand and Brothers (2000).

2. Dunham, C.W.. Planning of Industrial Structures, John Wiley and Sons (2001).

SCHOOL OF ENGINEERING
GAUTAM BUDDHA UNIVERSITY

CE 401 Foundation Engineering **Credit 04** **L:P:T: 3-1-0**

Introduction: This course is aimed to introduce and provide knowledge of advance technologies of Advance Soil and Foundation. Various aspects of Geotechnical and Foundation engineering will be discussed. Course will also help students to learn application of these technologies in various fields of engineering.

Aims and Objectives: At the end of this course students are able to-

- Learn the various aspects of Advance foundation technologies.

Course Delivery: A mix of instructional methods will be used like lectures, demonstration of softwares such as geostudio and tutorial exercises. Handout and reading references will be provided as and when required.

Evaluation Scheme:

Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weight-age for the different components is as follows:

a. Quizzes/ Class Tests/ Assignments	20%
b. Class Participation/ Presentation & Discussion	5%
c. Mid-term Exam	25%
d. Term- end Exam	50%

Session Plan (45 lecture sessions + 15 Sessions of tutorials, each of 60 minutes)

Unit- I

Types and general requirements of shallow foundation, Bearing capacity consideration, effect of ground water table, modes of failure, settlements of foundations, I.S. Code recommendations, (I.S. 6403, 8009). Design aspects of shallow foundation, Soil Stabilization (sand drains, compaction and dewatering of soils).

Unit -II

Wall foundation: Types, element and construction wall foundation, principles of design.

Unit-III

Types, purpose and classification of pile foundations, Construction of piles, pile load test, Load capacity and settlement of piles, Friction and under reamed piles; (individual pile & group of piles), Use of relevant I.S. Code (I.S. 2911: Part I-IV).

Unit –IV

Introduction to Coulomb's earth pressure theory for cohesive and granular soil, graphical methods. Classification of earth retaining structures (Rigid and Flexible). Analysis & Design of Sheet piles, bulk head anchored sheet pile (by free earth support method & fixed earth support method).

Unit –V

Introduction to soil dynamic, definitions, spring mass system, single degree of freedom system, free and forced vibration of damped and undamped systems. Type & criteria for design of machine foundation. Analysis and design of block foundation. Vibration isolation (active and passive method).

Text Books:

1. Bowles J.E, "Foundation Analysis and Design", McGraw-Hill, 1994
2. Murthy, V.N.S, "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd, New Delhi, 2008.

References:

1. Das, B.M. "Principles of Foundation Engineering (Fifth edition), Thomson Books / COLE, 2003.
2. Swamisaran, "Analysis and Design of Structures – Limit state Design", Oxford IBH Publishing Co-Pvt. Ltd., New Delhi, 1998
3. Kaniraj, S.R, "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2002
4. Gopal Ranjan and Rao, A.S.R. "Basic and Applied Soil Mechanics", Wiley Eastern Ltd., New Delhi (India), 2003.
5. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi publications pvt. ltd., New Delhi, 1995.
6. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 1995
7. N.N. Som and S.C. Das, "Theory and Practice of Foundation Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2003

CE 316: CAD LAB - I

[CE 553: CAD LAB
CREDITS: 02]
Batch 2015

L-T-P: 0-0-2 CREDITS: 01

Evaluation Scheme

- Sessionals : 50%
- End Term : 50%

Sat 9:30 — 11:30
11:30 — 1:30

Assignments:

Each student will submit the software results and their understanding of results in form of assignments.

List of Assignments:

1. Introduction to analysis and design software like STAAD - PRO (Structural Analysis and Design Software).
2. Design & analysis of Portal frame – SINGLE STOREY SINGLE BAY with STAAD-PRO software. Application of point load and Uniformly Distributed Load (u.d.l).
3. Design & analysis of Portal frame – SINGLE STOREY SINGLE BAY with STAAD-PRO software. Application of Joint Lateral Load (u.d.l).
4. Design and analysis of Portal Frame TWO STOREY TWO BAY with all load combinations.

CE 317: BUILDING DESIGN & DRAWING

L-T-P: 0-0-2 **CREDITS:01**

Drafting of following using any CAD software

1. Symbols used in Civil Engineering drawing, Masonry Bonds & Junction.
2. DPC, Lintels and Arches.
3. Doors, Windows and staircases.
4. Roof & roof covering.
5. Expansion & Contraction Joints.
6. Plumbing & Electrical fitting drawing.
7. Preparation of working drawings for the following
   i) RC Beams- Simply supported, Continuous, Cantilever
   ii) T – beam / L-beam floor
   iii) Slabs – Simply supported, Continuous, One way and two way slabs.
   iv) Columns – Tied Columns and Spirally reinforced columns.
   v) Isolated footings for RC Columns.
8. Comprehensive Drawing of Residential building (Layout, plan, elevation & sectional elevation, plumbing & electrical fillings in out)
9. Preparation of Layout planning of different Civil Engg. Projects.

CE 317: BUILDING DESIGN

CREDITS:01

L-T-P: 0-0-2

Drafting of following using any CAD software

1. Symbols used in Civil Engineering drawing, Masonry Bonds & Junction.
2. DPC, Lintels and Arches.
3. Doors, Windows and staircases.
4. Roof & roof covering.
5. Expansion & Contraction Joints.
6. Plumbing & Electrical fitting drawing.
7. Preparation of working drawings for the following
   i) RC Beams- Simply supported, Continuous, Cantilever
   ii) T – beam / L-beam floor
   iii) Slabs – Simply supported, Continuous, One way and two way slabs.
   iv) Columns – Tied Columns and Spirally reinforced columns.
   v) Isolated footings for RC Columns.
8. Comprehensive Drawing of Residential building (Layout, plan, elevation & sectio elevation, plumbing & electrical fillings in out)
9. Preparation of Layout planning of different Civil Engg. Projects.

70

CE551

CES 511: Advanced Soil Mechanics and Foundation

Credits- 3

L: T: P (2-1-0)

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT1: Soil foundation Interaction:
Introduction to soil foundation interaction problems, soil behaviour, foundation behaviour, interface behaviour, scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, two parameter elastic model, Elastic Plastic behaviour, Time dependent behaviour.

UNIT 2: Beam on Elastic foundation-soil models:
Infinite beam, two parameters, Isotropic elastic half space, analysis of beams of finite length, classification of finite beams in relation to their stiffness.

UNIT 3: Plate on Elastic medium:
Infinite plate, Winkler, two parameters, isotropic elastic medium, thin and thick plates, analysis of finite plates: rectangular and circular plates, Numerical analysis of finite plates, simple solutions.

UNIT 4: Elastic analysis of piles:
Elastic analysis of single pile, theoretical solutions for settlement and load distributions, analysis of pile group, interaction analysis, load distribution in groups with rigid cap.

UNIT 5: Laterally loaded pile:
Load deflection prediction for laterally loaded piles, sub-grade reaction and elastic analysis, interaction analysis, pile raft system, solution through influence charts.

Text Book:

1. Selva durai, A.P.S., "Elastic analysis of soil foundation interaction,"
2. Poulos, H.G. & Davis E.H., "Pile Foundation Analysis and Design,"
3. Scott, R.F., :Foundation Analysis By Structure Soil Interaction- State of Art Report," Institution of Structural Engineers, 1978.
4. Kramer, S.L, "Geotechnical Earthquake Engineering."
5. Bowles, J.E.," Foundation Analysis & Design," TataMcgGraw Hill, New Dlehi, India.
6. Lambe, T.W. & Whitman, R.V., "Soil Mechanics," New York, USA.

CE452/CE305: Environmental Engineering – II

Credits- 3

L: T: P (2-1-0)

Course Objectives:

- To expose students to the area of waste treatment – with emphasis on domestic liquid wastes – its characterization, collection, treatment and disposal at individual household level to community level - rural and urban.
- On completion of the course, the student is expected to know about the design principles involved in treatment of waste water.

Evaluation Scheme

TA

- Qiuzzes : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

Module- I: Sewerage System- Collection & Transmission

Sources, Characteristics and lying of sewerage system, Design and maintenance of sewers.

Module- II: Sewage Treatment – Primary Treatment

Unit Operations & Processes, Layout of wastewater Treatment Plant, Design of wastewater treatment systems, Waste stabilization.

Module- III: Sewage Treatment – Secondary Treatment

Kinetics of reactors, Aerobic and anaerobic digestion of sludge, Design, construction and operation of biological treatment systems.

Module- IV: Sewage Disposal

Methods: Dilution, Self purification of streams, Oxygen sag curve, Land disposal, Sewage farming, Wastewater reclamation techniques, Septic tanks (Design as per I.S. specification) Effluent disposal standards

Module- V: Sludge Disposal

Quality and characteristics of sludge, sludge elutriation and thickening, sludge conditioning – vacuum filtration, Sludge digestion, Design of Drying beds.

TEXT BOOKS:

1. Garg S.K., "Environmental Engineering Vol. II," Khanna Publishers, New Delhi, 1994.

2. Peavy H.S., Rowe D.R. & Tchobanoglous G., "Environmental Engineering," McGraw-Hill Company, New Delhi, 1995.

CE308 Irrigation Engineering

L: T: P (3-1-0) **Credits 4**

Evaluation Scheme

- Quizes : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

Unit-I Irrigation in India

Necessity, irrigation schemes, ongoing projects, engineering aspects of project planning ,Water application - crop types, water requirement and its estimation, water application, efficiencies, and techniques of irrigating fields.

Unit- II Canal irrigation

Introduction, Classification, Silt theories- problems of silting and scouring, Kennedy's theory, design procedure, drawbacks, Lacey's theory, design procedure, comparisons, drawbacks, design according to IS Lacey's non-regime equation Design -L-Section of a channel, Balancing depth, Use of Garrets diagrams, cross-section of irrigation channel; Canal lining- advantages, types of lining and design of lined channels.

Unit-III Diversion head works

Weirs and Barrages-Components, spillways, outlet works, functions, cause of failure, Blight's creep theory, Lane's weighted creep theory, Khosla's theory, pressure calculations,

Unit-IV Cross drainage works

Cross drainage works- Types of works, factors affecting suitability, classification of aqueducts and siphon aqueducts, Design- maximum flood discharge, waterway, transitions, head loss, uplift pressures,

B.Tech Programme Batch 2014 and 2015 (for lateral entry students)

Gautam Buddha University
School of Engineering

Course: CE 427

Industrial Training Seminar

(02 Credits)

- The Objective of the Industrial Training is to gain real time industry/research experience.
- Every 04 Yr B.Tech programme CE student has to do Industrial Training after the completion of 03th year.
- The Industrial Training can be done in industry/research organization/R & D lab/with on - going project in other institution.
- The Industrial Training should be relevant to the engineering application.
- The evaluation of the Industrial Training will be made by the departmental committee and distribution of marks will be as follows:
- Project Report : 25 marks

  Presentation : 25 marks

  Viva Voce : 50 marks

  Total : 100 marks
- Duration of Industrial Training will be 4 – 6 weeks.

CE 403: CONSTRUCTION PLANNING AND MANAGEMENT (2015 onwards)

L-T-P:3-0-0 **Credits:03**

UNIT 1: Project Management: Introduction, objectives of project, elements of project management- planning, scheduling, controlling; methods of project management – bar charts, milestone charts, network analysis.

UNIT 2: Fundamentals of Network: Introduction, A-O-A network diagrams, use of dummies, network rules, numbering of events – Fulkerson's rule.
A-O-N Diagrams: Introduction, representation of nodes in A-O-N networks, logic of A-O-N networks, advantages of A-O-N over A-O-A

UNIT 3: Program Evaluation and Review Technique: Introduction, time estimates, frequency distribution, normal probability distribution, beta probability distribution; expected time- of an activity, for activity in series; event time, slack, critical path, probability of completion of project

UNIT 4: Critical Path Method: Introduction, comparison between PERT and CPM, CPM networks, start and finish time of activity; float and its types - total, free, independent and interfering; super critical, critical and subcritical activities, critical path.

UNIT 5: Crashing, Updating & Resource allocation: Introduction, direct cost, indirect cost, optimum cost and optimum duration, cost slope, crashing, procedure of crashing, data required for updating, when to update, important considerations; resource allocation, resource levelling.

UNIT 6: Construction equipment and contract management: construction equipment management, equipment performance characteristics, selection, planning and matching of construction equipment, equipment management, legal aspects of contract, contract procedures and document, important contract clauses, quality control during construction.

BOOKS:

1. Modi P N, PERT and CPM Program Evolution and Review Technique and Critical Path Method, 5th Edition, Standard Book House-Delhi.
2. B C Punmia, Project Planning and Control with PERT & CPM, Fourth Edition, Laxmi Publications, 2016.
3. S K Battacharjee, Fundamental of PERT/CPM& Project Management, Khanna Publishers
4. Peurifoy, R.L. and Ledbetter, W.B.; Construction Planning, Equipment and Methods, McGraw Hill Singapore, 1986.
5. Joy, P.K.;Total Project Management – The Indian Context, New Delhi, MacMillan India Ltd.,1992
6. Uliman, John.E, et al; Handbook of Engineering Management, Wiley, New York, 1986.

CE647/ **CES 613: Hydraulic Structures**

L: T: P (2-1-0) **Credits- 3**

L:T:P(3-1-0) (credits-4

(Batch 2014 onwards

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1: Investigation and Planning - Preliminary investigations and preparation of reports, Layout of projects, Geological and hydrological investigations.

UNIT 2: Analysis and Design of Dams - Earthen Dam and Gravity Dam.

UNIT 3: Analysis and Design of Arch Dam, Infiltration Gallery, Collector wells.

UNIT 4: Construction of Dams - Masonry, Concrete and Earthen Dams, Foundation for Dams – Principles of Foundation treatment, Grouting methods.

UNIT 5: Design of Weirs on Permeable foundation - Creep theory, Potential theory, Flow nets, design of weirs - Khosla's theory.

Text Book:

1. Nalluri C., "Hydraulic Structures" Taylor & Francis,2001.

Reference Books:

1. Creager, W.P. Justin D, and Hinds, J., Engineering for Dams Vol. I, II and III.
2. Kushalani, K.B., Irrigation (practice and design) Vol. III and IV.

CE541 / CES 507: Advanced Construction Materials

L: T: P (3-0-0) Credits- 3

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1: Concrete as a composite material; Rheological properties of concrete; Microstructure studies in concrete, techniques for measurement of porosity

UNIT 2: Reinforcement corrosion: an electrochemical process, techniques for corrosion monitoring, corrosion protection measures, application of coatings on rebar, corrosion inhibitors in concrete

UNIT 3: Use of industrial waste and their influence on physical, mechanical and durability properties of concrete; Fiber reinforced concrete: mechanism of fiber reinforcement, types of fibers, properties of fiber reinforced concrete.

UNIT 4: High strength concrete: constituents, mix proportioning, properties at fresh and hardened state; Reactive powder concrete; Macro Defect Free (MDF) cement; Self compacting concrete; Roller compacted concrete; Ferrocement composites; Polymers in construction, polymer concrete composites; Chemical testing of concrete.

UNIT 5: Non-destructive evaluation of reinforced concrete by surface hardness techniques, wave propagation techniques, penetration resistance techniques, electrochemical and electromagnetic techniques.

Text Book:

1. A.R. Santhakumar, Concrete Technology, Oxford University Press, 2006.

Reference Books:

1. Krishnaraju, N., Advanced Concrete Technology, CBS Publishers, 1985.
2. Nevile, A.M., Concrete Technology, Prentice Hall, Newyork, 1985.
3. Ghambhi. M. L., Concrete Technology.
4. Shetty, M.S., Concrete Technology.

CE543/ **CES 510: APPLIED ELASTICITY AND PLASTICITY**

L: T: P (3-1-0)

L: T: P (2-1-0)

Credits- 4

(credits - 3
(Batch 2015 onwards) 024

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT I Basic Theory: Concept of continuum, Vector and Tensor analysis.

UNIT II Elasticity: Stress tensor and transformation, Equilibrium conditions, Simple state of stress, Strain displacement relations, strain tensors and its transformation, Compatibility conditions, Constitutive relations.

UNIT III: Energy Methods: Energy principles, Problems of linear elasticity- basic equation, Boundary value problems, Solution of basic equation and Equation of plane problems.

UNIT IV Plasticity: Plastic solid, Loading and unloading conditions, Isotropic stress deformation theory, Yield functions, Work hardening and Flow rules.

UNIT V Visco-elasticity: Visco-elastic material, Stress strain relation, Various models, Creep and Relaxation, Compliance and Modulus of mechanical models, Navier's equation.

BOOKS:

1. Fung, Y.C., Fundamentals of Continuum Mechanics, Prentice Hall, Englewood Cliffs (1969).
2. Karasudhi, P., Fundamentals of Solid Mechanics, Kluwer Academy Boston (2007).
3. Khan, A.S and Huang, S., Continuum Theory of Plasticity, John Wiley (1995).
4. Shames, I.H and Cozzarelli, Elastic and Inelastic Stress Analysis, Taylor and Francis (1997).
5. Spencer, A.J.M., Continuum Mechanics, Longman Group. (1980).
6. Truessdell, C., The Elements of Continuum Mechanics, Springer-Verlag (1966).
7. Timoshenko, S.P. and Goodier, J.N., " Theory of elasticity," Mc Graw Hill London, U.K.

CE545 / CES 505: Structural Dynamics

L: T: P (2-1-0) Credits-3

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT I: Types of vibration and ground motions, Free and forced vibrations of single degree of freedom system, response to harmonic, periodic, impulsive and general dynamic loading, response of SDOF to earthquake.

UNIT II: Free vibration of lumped multi degree of freedom system; approximate methods for obtaining natural frequencies and mode shapes; Frequencies domain analysis of lumped multi degree of freedom system using normal mode theory.

UNIT III: Time domain analysis using numerical integration scheme.

UNIT IV: Free and forced vibrations of continuous system.

UNIT V: Dynamic analysis of tall and massive structures.

Text Books:

1. Krishna, Jai, Chandrasekharan, A.R., Chandra, Brijesh, Elements of Earthquake Engineering, South Asian Publishers, New Delhi.

Reference Books:

1. Agarwal, Pankaj, Shrikhande, Manish., Earthquake Resistant Design of structures, Prentice –Hall India.
2. Duggal, S.K.., Earthquake Resistant Design of Structures, Oxford University Press.
3. Tedesco, J.W., McDougal, W.G., Ross, C.A., Structural Dynamics - Theory and Application, Addison- Wesley, England.
4. Steven & Kramer.-Geotechnical Earthquake Engineering, Pearson Education
5. Chopra, Anil.K., Dynamics of Structures. Pearson Education.
6. IS 1893 (Part-I)- 2002 : "Criteria for Earthquake Resistance Design of Structure".

CES547/ CES 501: FINITE ELEMENT METHOD

.: T: P (2-1-0) **Credits- 3**

:valuation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1 BASIC FINITE ELEMENT CONCEPTS: Finite element equations using modified Galerkin method, Application: Axial deformation of bars, Axial spring element. Approximate solution of boundary value problems-Methods of weighted residuals, Approximate solution using variational method, Modified Galerkin method, Boundary conditions and general comments.

UNIT 2: Higher order elements for **ONE DIMENSIONAL PROBLEMS**-Shape functions for second order problems, Isoparametric mapping concept, Quadratic isoparametric element for general one dimensional boundary value problem, One dimensional numerical integration, Application: Heat conduction through a thin film.

UNIT 3 TWO DIMENSIONAL BOUNDARY VALUE PROBLEMS using triangular elements, Equivalent functional for general 2D BVP, A triangular element for general 2D BVP, Numerical examples, Isoparametric quadrilateral elements, Isoparametric triangular elements.

UNIT 4 NUMERICAL INTEGRATION: Newton-Cotes rules, Trapezium rule, Simpson's rule, Error term, Gauss-Legendre rules, Changing limits of integration, Gauss-Leguerre rule, Multiple integrals, Numerical integration for quadrilateral elements, Numerical integration for triangular elements, Applications based on general two dimensional boundary value problem-Ideal fluid flow around an irregular object, Two dimensional steady state heat flow, Torsion of prismatic bars. Two dimensional elasticity-Governing differential equations, Constant strain triangular element, Four node quadrilateral element, Eight node isoparametric element.

UNIT 5 AXISYMMETRIC ELASTICITY PROBLEMS: Governing equations for axisymmetric elasticity, Axisymmetric linear triangular element, Axisymmetric four node isoparametric element.

Text Book:

1. J. N. Reddy, "Finite Element Method", Tata Mc Graw Hill.

Reference Books:

1. C. S. Desai and John F.Abel, "Introduction to Finite Elements Method", Litton Educational Publishing Inc.
2. O. C. Zienkiewicz, "The Finite Element method", Tata Mc Graw Hill.
3. Erik G. Thompson, "Introduction to Finite Element Method", John Wiley & Sons.

CE542 / CES 502: PRESTRESSED CONCRETE

L: T: P (3-1-0) **Credits- 4**

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

NOTE: Design paper should have 4 questions in mid term and end term examination.

UNIT 1: Introduction, Prestressing Systems and Losses in Prestress

UNIT II: Analysis and design of prestress concrete flexure members

UNIT III: Analysis and Design for Shear, bond and bearing

UNIT IV: Analysis and Design of Compression and tension members.

UNIT V: Design of prestress members: Slab & grid floor.

TEXT BOOK:

1. Krishna Raju, N., Prestressed Concrete, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 1998.

REFERENCES:

1. Lin, T. Y. and Burns, N. H., Design of Prestressed Concrete Structures, 3rd Edition, John Wiley & Sons, 1982.
2. Abeles, P. W., The Principles and Practice of Prestressed Concrete, Crosby Lockwood and Sons, 1949.

CES504: ADVANCED STRUCTURAL ANALYSIS

L: T: P (2-1-0) Credits- 3

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1 Matrix analysis of structures with axial elements:

Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof); **One-dimensional axial structures:** Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method.

UNIT 2: Matrix analysis of trusses: Analysis by conventional stiffness method (four dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method; **Space trusses:** Analysis by conventional stiffness method (six dof per element) and reduced element stiffness method (single dof).

UNIT 3 Matrix analysis of beams and grids:

Conventional stiffness method for beams: Beam element stiffness (four dof); generation of stiffness matrix for continuous beam; dealing with internal hinges, hinged and guided-fixed end supports; accounting for shear deformations; **Reduced stiffness method for beams:** Beam element stiffness (two dof); dealing with moment releases, hinged and guided-fixed end supports; **Flexibility method for fixed and continuous beams:** Force transformation matrix; element flexibility matrix; solution procedure (including support movements).

UNIT 4: Matrix analysis (Stiffness method) for grids: Introduction; torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element with six dof; analysis by reduced stiffness method (three dof per element).

UNIT 5 Matrix analysis of plane and space frames:

Conventional stiffness method for plane frames: Element stiffness (six dof); generation of structure stiffness matrix and solution procedure; dealing with internal hinges and various end conditions; **Reduced stiffness method for plane frames:** Element stiffness (three dof); ignoring axial deformations; dealing with moment releases, hinged and guided-fixed end supports; **Flexibility method for plane frames:** Force transformation matrix; element flexibility matrix; solution procedure (including support movements); Ignoring axial deformations; **Stiffness method for space frames:** Introduction; element stiffness matrix of space frame element with 12 dof and 6 dof; coordinate transformations; analysis by reduced stiffness method (six dof per element).

TEXT BOOK:

1. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2009.

RECOMMENDED BOOKS:

1. Gere, G. M. and Weaver, Jr. W., Matrix Analysis of Framed Structures, CBS Publishers (1987).
2. McCormac, J. C. & Nelson, J. K., Structural Analysis: A Classical and Matrix Approach, John Wiley and Sons (1997).
3. Pandit & Gupta, Matrix Analysis of Structures, Tata McGraw Hill Publications (2003).
4. Iyengar, N.G.R., Elastic Stability of Structural Elements, Macmillan India Ltd (1980).
5. Asslam Kassimali, "Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA, 1999.
6. Amin Ghali, Adam M Neville and Tom G Brown, "Structural Analysis: A Unified Classical and Matrix Approach", Sixth Edition, 2007, Chapman & Hall.
7. Devdas Menon, "Structural Analysis", Narosa Publishing House, 2008.
8. Meck, J.L., 'Structural Analysis."

CE546 / CES 506: ADVANCED CONCRETE DESIGN

Credits- 3

Credits-4 &
(Batch-2015
02 Yr M.Tech

L: T: P (2-1-0)

LTP (3-1-0)

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT I Limit state design concepts in flexure shear and torsion, combined stresses and slender columns, safety and serviceability, control of crack and defection.

UNIT II YIELD LINE THEORY: Introduction, Assumptions, Location of yield lines, Equilibrium and Virtual work methods, Hillerberg's strip method, Design of Circular & Flat slabs.

UNIT III SPECIAL STRUCTURAL ELEMENTS: Domes, Deep Beams, Curved Beams, Brackets or Corbels, Grid floor systems.

UNIT IV: FOLDED PLATES: General Features, Structural Behaviour, Analysis & Design of Folded Plates.

Text Book:

1. S.U. Pillai and D. Menon, "Reinforced Concrete Design", Tata McGraw Hill, 3rd Edition.

Recommended Books:

1. Jain, A.K., Reinforced Concrete-Limit State Design, Nem Chand & Bros (1999).
2. Varghese, P. C., Limit State Design of Reinforced Concrete, PHI Publishers (2002).
3. Lin, T. Y. and Burns, N. H., Design of Prestressed Concrete Structures, 3rd Edition, John Wiley & Sons, 1982.
4. B.C. Punmia, Ashok K. Jain and Arun K. Jain, "Reinforced Concrete Structures, Vol, 1", Laxmi Publications, 1992.
5. M.L. Gambhir, "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, 2006.

CE548 / **CES 508: BRIDGE DESIGN**

L: T: P (2-1-0)

L: T: P (3-1-0)

Credits- 3/04

((redits : 4
Batch 2015
02 4r
Onward

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

NOTE: Design paper should have 4 questions in mid term and end term examination.

UNIT I: General classification, site selection, geometric and hydraulic design considerations, loading standards for highway and railway bridges, general design considerations.

UNIT II CONCRETE BRIDGES: Introduction, T-beam bridge, balanced cantilever bridge, cable stayed bridge, arch bridge.

UNIT III STEEL BRIDGES: Introduction, plate girder bridge, truss bridge, suspension cable bridge, cable-stayed bridge.

UNIT IV: SUBSTRUCTURE: Design of piers and abutments, Pile and Well foundation, Bearings, Seismic design considerations.

TEXT BOOK:

1.Victor, Johnson, "Essential of Bridge Engineering," Oxford New Delhi, INDIA

REFERENCES:

1. Bakht, B. and Jaeger, L.G., Bridge Analysis Simplified, McGraw-Hill Book Company (1985).
2. Cusens, A.R. and Parma, R.P., Bridge Deck Analysis, John Wiley & Sons Ltd. (1975).
3. Hambly, E.C., Bridge Deck Behaviour, Chapman and Hall. (1991).
4. Krishna Raju, N., Design of Bridges, Oxford and IBH Publications (1998).
5. Ponnuswamy, R., Bridge Engineering, Tata McGraw Hill (1997) . .
6. Relevant Road & Railway Codes for Bridges.
7. Raina, V K , Concrete Bridge Practice, Tata McGraw Hill Publications (1991).

CE554 / CES 514: Earthquake Resistant Design of Structures

Credits- 4

L: T: P (3-1-0)

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

NOTE: Design paper should have 4 questions in mid term and end term examination.

UNIT 1: Characteristics of Eathquake: Earthquake terminology, magnitude, intensity, measurement of ground motion, frequency-magnitude relationships, liquefaction. Strong ground motion: Acceleration time histories, peak parameters, response spectrum, site effects.
UNIT II: Earthquake Analysis of Structures: Idealization of structures, response spectrum analysis, equivalent force concepts, torsionally coupled systems.
UNIT III: Concepts of earthquake resistant design: objectives, ductility reduction factor, over-strength, response reduction factor, design response spectrum, lateral stiffness, building configuration. Base isolation, concept of structural control.
UNIT IV: Building codes: Performance of buildings in past earthquakes, historical perspective of code development, Indian codes (IS: 1893), provisions for buildings.
UNIT V: Retrofitting and strengthening of structures: IS 13935. Detailing for reinforced concrete and masonry buildings, provisions of IS: 13920, IS: 4326, IS: 13927, IS:13928.

Text Books:

1. Agarwal, Pankaj, Shrikhande, Manish., Earthquake Resistant Design of structures, Prentice –Hall India.
2. Duggal, S.K.., Earthquake Resistant Design of Structures, Oxford University Press.

Reference Books:

1. Tedesco, J.W., McDougal, W.G., Ross, C.A., Structural Dynamics - Theory and Application, Addison- Wesley, England.
2. Steven & Kramer.-Geotechnical Earthquake Engineering, Pearson Education
3. Krishna, Jai, Chandrasekharan, A.R., Chandra, Brijesh, Elements of Earthquake Engineering, South Asian Publishers, New Delhi.
4. Chopra, Anil.K., Dynamics of Structures, Pearson Education.
5. IS 1893 (Part-I)- 2002 : "Criteria for Earthquake Resistance Design of Structure".

CE556/ CES516: STRUCTURAL ANALYSIS LAB-I

CREDITS: 02

L-T-P: 0-0-3

Evaluation Scheme

- Sessionals : 50%
- End Term : 50%

List of Experiments:

1. Determination of shear centre for angle and channel sections.
2. Study of Stress-strain behavior of M.S. Bar under axial tension and determination of elastic modulus.
3. Assessment of strength of cubes using NDT.
4. Measurement of strain in mild steel strip in axial tension using strain gauges.
5. Crack width measurement in beams.
6. Spacing of reinforcement using rebar locator.
7. Analysis of two and three hinged arches.

CE516 /CES 518/ CEE 516: Project

L: T: P (0-0-10) **Credits- 5**

Examination

Sessionals/Guide Assessment	25%
Mid-Term presentation of project:	25%
End-Term presentation of project and submission	50%

Project Submission:

1. Student groups will be given a project on various topics related to relevant engineering areas.
2. Student groups will be assigned a faculty member with whom they have to discuss their project problem minimum of three hours in a week.
3. On regular basis work will be evaluated by faculty in-charge.
4. Presentations of the project work will be held from time to time.
5. Submission of the project work will be held at the end of the semester.

Faculty credits:

- For guiding one group of M.Tech. student for project, faculty will get 1 credits and 1 contact hour per week for each student.

CE643 | **CES603: Advanced Steel Design**

L: T: P (3-1-0) **Credits- 4**

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1:

Analysis and design of steel chimneys and tanks.

UNIT 2:

Design of steel towers (transmission line and microwave towers); loads, classification and design procedure.

UNIT 3:

Design of circular tubular sections, Brittle fracture and fatigue in steel structures.

UNIT 4:

Plastic design of steel structure.

Text Book:

B.G. Neal, " Plastic Design."

References:

1. Arya, A.S., Design of Steel Structures, New Chand & Brothers, New Delhi 1982.
2. R.P. Johnson, "Composite Structures of Steel & Concrete", Blackwell Scientific publications, UK, 1994.
3.Ram Chandra, " Design of steel structures."
4. Subramanian, "Design of Steel Structures."

CE641 / **CES601: PLATES AND SHELLS**

Credits- 3

L: T: P (2-1-0)

Evaluation Scheme

Sessionals

- Quiz : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

UNIT 1: Plates

Basic concept, governing equations, boundary conditions, solution of rectangular and circular plates by classical methods and numerical methods, plates of various shapes, design criteria.

UNIT 2: Shells

Basic concepts, membrane and bending analysis of cylindrical shells, shell of revolution, edge perturbations and secondary stresses, numerical solutions.

UNIT 3: Approximate Methods

Design methods for doubly curved shells; design criteria, code specification and parametric proportioning, stability considerations;

UNIT 4: Folded plates

Forms, structural action, method of analysis, design considerations

Text Book:

Stephen .P. Timoshenko & Woinowsky Krieger, "Theory of Plates and Shells," McGraw Hill, 1984

Reference Book:

1. Rudolph Szilard, "Theory and Analysis of Plates," Prentice Hall, New Jercy 1986.
2. Ramaswamy, " Theory of Shells."
3. Jaeger, " Plates and Shells."

CE501

CE 555 : ENERGY AND ENVIRONMENT

Credits: 03 – L:T:P (2-1-0) Examination Hours : 03 Max. Marks: 100

Evaluation Scheme

TA

- Qiuzzes : 10%
- Assignments : 10%
- Class Participations : 5%

Examination

- Mid Term : 25%
- End Term : 50%

(30 Sessions each of 60 minutes)

Unit - I

Energy Requirement of Society: Energy requirement: past and present situation, availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Hydel power plant, tidal energy, biomass energy, wind energy, Hydrogen as a source of energy, energy conversion technologies, their principles, equipment and suitability in context of India. Environmental impacts of these technologies. **(10 Lectures)**

Unit II

Environmental Friendly Technologies: Sources, methods of solar energy collection, process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and application, environmental impacts of solar energy.

Biomass option: Concept of biomass energy utilization, types of biomass energy, conversion processes, biogas production, biomass gasification process and technologies, environmental impacts of biomass energy, waste to energy **(10 Lectures)**

Unit -IIII

Energy Storage and Heat Energy Recovery: Types of energy storage, devices for sensible and latent heat storage, energy storage in dry batteries, nickel-cadmium batteries, secondary hea storage, chemical storage, environmental consequences of energy storage systems.

SCHOOL OF ENGINEERING

GAUTAM BUDDHA UNIVERSITY

CE503

CE 407/ CE553: Remote Sensing and GIS **Credit 03** **L:T:P: 2-1-0 / 2-1-0**

Introduction: This course is aimed to introduce and provide knowledge of advance technologies of surveying and data collection alongwith a system i.e., GIS to manage and analyse such geographically referenced data. Various aspects of remote sensing and GIS technologies will be discussed. Course will also help students to learn application of these technologies in various fields of engineering.

Aims and Objectives: At the end of this course students are able to-

- Learn the various aspects of remote sensing & GIS technologies.
- They will be able to finalise and order the remote sensing data for different engineering applications.
- They will be able to extract the different type of information from different remote sensing data products after its pre and post processing i.e., digital image processing.
- They will able to use GIS for generation of various thematic layers and integration of various type of information in GIS.
- They will able to use GIS database for planning and analysis of different projects and phenomenon.

Learning Outcomes: At the end of this course students will be able to:

- Use remote sensing data products for surveying and data collection.
- Extract different type of information from the remote sensing data products required in various engineering applications.
- Easily and efficiently use GIS for generation of database and its use for different engineering applications.

Course Delivery: A mix of instructional methods will be used like lectures, demonstration of softwares and tutorial exercises. Handout and reading references will be provided as and when required.

Evaluation Scheme:

Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weight-age for the different components is as follows:

a. Quizzes/ Class Tests/ Assignments 20%

CE 505: WATER TREATMENT PROCESSES

L-T-P: 2-1-0 **Credits: 03**

Unit 1: Introduction – water quality parameters, sources; Water intake (surface and subsurface), screening of water, different types and arrangements of screens, aeration – removal of dissolved gases, iron and manganese, Sedimentation theory, different types of settling and their applications

Unit 2: Coagulation and flocculation – basic concepts, various types of coagulants and their applications, design of flocculators; theory of filtration, types of filters - rapid and slow sand filters and dual filters, various types filter design

Unit 3: Water softening; chemical precipitation -ion balance; ion exchange - ion exchange principles, cation and anions exchangers, types of resins and their suitability

Unit 4: Disinfection - theory of disinfection, common disinfectants, suitability of disinfectants, chlorination – pre-chlorination, post chlorination, super-chlorination, de-chlorination, design of disinfection facilities

Unit 5: Advance water treatment techniques; membrane separation techniques – microfiltration, ultra-filtration, nanofiltration, reverse osmosis; adsorption - types of adsorbents, applications and limitations, adsorption isotherms.

Text books:

1. Environmental Engineering, Peavy and Row, Tata McGraw Hills Pvt. Ltd. New Delhi, India
2. Water Supply, Steel and McGhee, McGraw Hill Publications
3. Water Technology, Hammer and Hammer, Tata McGraw Hills Pvt. Ltd. New Delhi, India

Reference Books:

1. Environmental Engineering, Gerard Kiely, The McGraw Hill Co. USA
2. Environmental Engineering, Sincero and Sincero, Tata McGraw Hills Pvt. Ltd. New Delhi, India
3. Introduction to Environmental Engineering and Science, Gilbert and Masters, Pearsons, Education

28/7/18

15th BOS Meeting held on 28th July 2018

School of Engineering

Gautam Buddha University

CE507 / CE 553 : ENVIRONMENTAL CHEMISTRY & MICRIBIOLOGY

Credits: 03 – L:T:P (2-1-0) **Examination Hours : 03** **Max. Marks: 100**

Course Background

The course provides a platform for environmental scientists and engineers to integrate their respective skills spanning from scientific theories and principles explaining environment and its problems at local and global level to technical and engineering solutions to the same. This course will provide enormous opportunities to the students for achieving technical and practical excellence through academic networking with reputed institutes, regular workshops, seminars, industry visits and collaborative research. After completing the course, the students have a host of career options in industry (particularly in Effluent Treatment Plants, Air Pollution Abatement and Solid Waste Management), Environmental Management & Planning, Pollution Control Boards, Environmental Consultancy and R&D in Public and Private Sectors.

Scope of Environmental Chemistry and Microbiology

Environmental Chemistry and Microbiology is an important area in environmental engineering which has emerged as an independent discipline to understand the fundamentals of environmental pollution and problems. The following are the objectives and core values of the subject:-

- To educate the students in the area of water, air and soil chemistry and train them in the laboratory in the determination of pollutants present in air, water, wastewater and soil.
- Promote academic excellence.
- Raise the level of knowledge, competence and skills in the area of Environmental engineering and Environmental Chemistry and Microbiology in particular.
- Implementation of new curriculum and innovative instructional methods, such as self-paced learning, problem-solving projects.
- Establish and expand research capabilities for students and faculty.
- Consulting projects that will serve industry and the community.

The pedagogy will be a mixed of lectures, experience sharing, real life case discussions, assignments and industry/ research based projects. The course is based on strategic issues with cases as the primary vehicle for learning. In addition to reading materials, additional reading and cases will be distributed in the class from time to time. Students are also expected to prepare and analyze all the cases as class participation is very important.

Course requirement

i) Since much of the course material requires class lectures and discussions, it is important that you are prepared for the class, present and defend your ideas. Preparation for the class includes having read the assignment material.

ii) There will be several home assignments related to the subject and a number of unannounced quizzes. Late submissions of assignments will not be accepted and there will be no makeup quizzes.

iii) Class participation will be based on the value you add to the class through your questions, statements and comments. The quality of questions, statements and comments is more important than the quantity of these.

Evaluation Scheme

TA

Qiuzzes : 10%

Assignments : 10%

Class Participations : 5%

Examination

Mid Term : 25%

End Term : 50%

(45 Sessions each of 60 minutes)

UNIT I

Chemistry of pollutants in Air: Fundamentals of Environmental Chemistry for Environmental Engineers, Chemistry of pollutants in the Atmosphere: Solid, liquid, gaseous and radioactive pollutants in the atmosphere, formation of physical processes of pollutants in the atmosphere, Effects of temperature, solar radiation and wind current on the various pollutants, Effect of gravitational force and rain scrubbing on air pollutants, Chemical properties of air pollutants

chemisorptions, effect of solar radiation on acidic basic characteristics, reducing, oxidizing properties of air pollutants, Colloidal Chemistry. (7 Lectures)

UNIT II

Chemistry of pollutants in the water: Solute, Solvent and solubility, Interaction of water with organic and Inorganic species (Natural & Anthropogenic), Chemical Equilibria and Kinetics Fundamentals, Significance of Acids and Bases, Chemical equilibrium calculations; pC-pH diagram, Langelier index, Solubility diagram; Oxidation and Reduction reactions, Basic Concepts of Bio-Chemistry: kinetics of biochemical operations, respiration and energy generation, enzyme kinetics and regulation (8 Lectures)

UNIT III

Pollution Measuring Instruments Used: Theory and Applications: Colloids – Redox potentials – partition co-efficient – Beer – Lambert's Law – Limitations – UV visible spectroscopy basic principles – application – Atomic absorption spectroscopy – Principles – applications Gas chromatograph – Principles and applications – Principles of green chemistry – Error Analysis of Environmental Data Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis - Degradation of food stuffs, detergents, pesticides and hydrocarbons. Soil chemistry- acid-base and ion-exchange reactions in soil - salt affected soil and its remediation. (7 Lectures)

UNIT IV

Microbiological Concepts: Introduction to Environmental Microbiology, Microorganism Cells and its Structure, Types and metabolic classification of micro organisms, characterization techniques, reproduction, Microbial metabolism and growth kinetics

Bacteria: classification and characteristics of bacteria, Bacterial genetics; cell morphology, growth rate curve, culture techniques, Gram staining, microscopic methods, MPN, Plate count and membrane filter techniques.

Algae: classification, symbiosis, factors affecting algal growth, control of algae, Fungi, moulds, protozoa , population dynamics, role of microbes in biological waste treatment, significance of F/M ratio, acclimatization of bacteria, bioassay tests, aerobic and aerobic metabolism.

(8 Lectures)

Suggested books

Text Books:

CE 502: BIOLOGICAL PROCESSES OF WASTEWATER

L-T-P:3-1-0

Credits: 04

Unit I: Microorganisms in Wastewater Treatment, Microbiological Concepts- cells, classification and characteristics of living organisms, Characterization Techniques, Microbial Metabolism, Basic metabolic models, Chemistry of carbohydrates, proteins, fats and lipids. Population Dynamics

Unit II: Principles of Biological Treatment, Treatment Kinetics, Substrate Removal Efficiency. Reactor Profiles, Continuous Flow Reactors-Hydraulic and Performance Characteristics (Pulse and Step Input Response)

Unit III: Aerobic Systems-Aerobic Biological Treatment, Kinetics of Organics Removal, Substrate Utilization and Biomass Growth, Monod's Kinetics, Estimation of Kinetic Parameters, Cell Yield, Sludge Settling, Nutrient Requirements, Activated Sludge Process Description and its Modifications, Process Design, Process Performance Evaluation and Troubleshooting, Extended Aeration, Design of Aeration Systems, Design of Secondary Settlers, Sludge Bulking and Foaming

Unit IV: Biofilm Processes, Trickling Filter, Biotowers, Substrate Removal Attached Growth System, Rotating Biological Contactors, Oxidation Ditches, Stabilisation Ponds and Aerated Lagoons- Types and their Description, Design, Operation and Maintenance, Aerobic Digestion. Sequencing batch reactor and Process Design, Wetland Treatment Systems, Membrane Bioreactor, Moving Bed Biofilm Reactor

Text Books and/or Reference Materials

1. Pelczar, "Microbiology", Tata McGraw-Hill Education, Aug-1998
2. Metcalf and Eddy, "Wastewater Engineering: Treatment and Reuse, Tata McGraw Hill Edition.
3. Rittman Bruce, "Environmental Biotechnology", McGraw Hill Publications
4. Ronald L Droste, "Theory and Practice of water and Wastewater Treatment", Wiley Publications.
5. Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press

School of Engineering

Name of the Course: AIR AND NOISE POLLUTION L:T:P (3-1-0) 4- Credits

Course Code: CE508/CE434 / CE 506

Course Objectives: This advanced course focuses on various technical aspects related to air and noise pollution control and their management issues. The topics include micrometeorology; air dispersion modelling; advanced air pollution control (e.g. process modification, energy audit and emission trading); case studies on control of emissions from stationary and mobile source; concept of sound propagation; basic principles of noise control; noise impact assessment and technical mitigation measures for construction, industrial, road traffic, railway and aircraft noise.

Learning Outcomes:

1. To provide students with advanced understanding of metrological processes, pollution dispersion, problems associated with air and noise pollution, data collection & analysis and identify the strategies of solving the environmental impacts.
2. To equip students with a wide range of skills in monitoring, collection and analysis of data related to air and noise pollution.

Course Delivery:

A mix of instructional methods like lectures, demonstration of equipments, and tutorial exercises will be used. Handouts and reading references will be provided as and whenever required.

Evaluation Scheme

1. Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

   The weightage for different components is as follows:

- Qiuzzes/Class test/Assignments : 20%
- Class Participation/Presentation & Discussion : 5%
- Mid Term Exam : 25%
- End Term Exam : 50%

School of Engineering

CE508

Name of Course: CE-510 -- Advance Hydrology

L:T:P (3-1-0) 3-Credit
Credit = 4
onwards 2015

Course Objectives

The subject will present advanced concepts and techniques in surface and groundwater hydrology. It will focus on today's major water resources issues in India and the rest of the World. It is intended to provide the students with an advanced understanding of the concepts and techniques necessary to identify, quantify, map and monitor the natural hydrological processes and assess the impact of activities.

Learning Outcomes

- to provide students with an advanced understanding of hydrological processes, methods for hydrological analysis and design as well as water quantity and availability issues;
- to engage students with quantitative methods that are used to measure natural hydrologic processes;
- to provide students with a better understanding of the general earth and environmental sciences from a hydrological perspective;
- to equip students with a wide range of skills encountered in hydrological practice.

Course Delivery

A mix of instructional methods will be used like lectures, demonstration of equipment and tutorial exercises. Handout and reading references will be provided as and wherever required.

Evaluation Scheme:

- Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

The weight age for the different components is as follows:

a.	Quizzes/ Class Tests/ Assignments	20%
b.	Class Participation/ Presentation & Discussion	5%
c.	Mid-term Exam	25%
d.	Term- end Exam	50%

CE 510: URBAN WATER MANAGEMENT

L-T-P:2-1-0 **Credits: 03**

UNIT 1: General introduction to urbanization and its effect on water cycle – urban hydrological cycle – trends in urbanization – Effect of urbanization on hydrology.

UNIT 2: Urban Hydrological cycle – time of concentration – importance of short duration of rainfall and runoff data – methods of estimation of time of concentration for design of urban drainage systems.

UNIT 3: Basic approaches to urban drainage – runoff quantity and quality – wastewater and storm water reuse – major and minor systems. Elements of drainage systems – open channel – underground drains – appurtenances – pumping – source control.

UNIT 4: Master drainage plans – issues to be concentrated upon – typical content of an urban drainage master plan – interrelation between water resources investigation and urban planning processes – planning objectives – comprehensive planning – use of models in planning.

UNIT 5: Storm water Analysis Calculation of runoff and peak – Design of storm water network systems. Best Management Practices – Detention and retention facilities – Swales-constructed wetlands. Operation and maintenance of urban drainage system – interaction between stormwater management and solid waste management, Various model available for stormwater management. Legal aspects

Books:

1. Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, Manual on Drainage in Urbanised area – 2 volumes, UNESCO, 1987
2. Hall M J , Urban Hydrology, Elsevier Applied Science Publisher, 1984
3. Stahre P and Urbonas B , Stormwater Detention for Drainage, Water Quality and CSO Management, Prentice Hall, 1990
4. Wanielista M P and Eaglin ,Hydrology – Quantity and Quality Analysis, Wiley and Sons, 1997

(60 Sessions each of 60 minutes)

Unit-I Solid Waste
Origin, Types, characteristics, Quantity and Analysis; Effects of Solid Wastes on environment, Solid waste transformation, Legislation in solid waste, Waste generation rates, Composition, Hazardous Characteristics, Toxicity characteristic leaching procedure (TCLP) tests, waste sampling, Source reduction of wastes, Recycling and reuse, Integrated solid waste management

Unit-II Collection and Transportation of Solid Waste
Handling and segregation of wastes at source, storage and collection of municipal solid wastes, Analysis of Collection systems, Need for transfer and transport, Transfer stations,

Unit-III Solid Waste Disposal
Disposal in landfills, site selection, design and operation of sanitary landfills, landfill remediation, Elements of integrated waste management

Unit-IV Hazardous Waste
Definition, Sources and classification of hazardous wastes, labeling and handling of hazardous wastes, Risk and risk assessment, management and handling of hazardous wastes, and biomedical wastes

Unit-V Waste to Energy
Waste processing, processing technologies, biological and chemical conversion technologies, Composting, thermal conversion technologies, energy recovery, incineration, solidification and stabilization of hazardous wastes,

Text Books:

1. Tchoboglous, G., Theisen and Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw Hill, 1993
2. Wentz, C. A., Hazardous Waste Management, 2nd Ed., McGraw Hill, 1995.
3. Bhide A.D and Sudarshan (1976) Solid waste management in developing countries.
4. Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, CPHEEO, Government of India, New Delhi, 2000.

Reference Books:

1. La Grega, M. D., Buckingham, P. L. and Evans, J. C., Hazardous Waste Management, 2nd Ed., McGraw Hill, 2001.
2. Bagchi, A., Design, Construction and Monitoring of Landfills, Wiley Interscience, 1994.
3. Haas, C. N. and Vamos, R. J., Hazardous and Industrial Waste Treatment, Prentice Hall, 1995.
4. Martin, E.J. and Johnson, J.H., Hazardous Waste Management Engineering, Van Nostrand, 1987.
5. Lewandowski, G.A. and DeFilippi, L.J., Biological Treatment of Hazardous Wastes, John Wiley & Sons, INC., 1998.
6. Kuhre, W. L., Practical Management of Chemicals and Hazardous Wastes: An Environmental and Safety Professional's Guide, Prentice Hall, 1995.

School of Engineering

Gautam Buddha University

CE601/CE531: SOLID AND HAZARDOUS WASTE MANAGEMENT

Credits: 04 – L:T:P (3-1-0) **Examination Hours : 03** **Max. Marks: 100**

Course Background

The course provides a platform for environmental scientists and engineers to integrate their respective skills spanning from scientific theories and principles explaining solid and hazardous waste and its management at local and global level to technical and engineering solutions to the same. This course will provide enormous opportunities to the students for achieving technical and practical excellence through academic networking with reputed institutes, regular workshops, seminars, industry visits and collaborative research. After completing the course, the students have a host of career options in industry (particularly in Effluent Treatment Plants, Air Pollution Abatement and Solid and Hazardous Waste Management), Environmental Management & Planning, Pollution Control Boards, Environmental Consultancy and R&D in Public and Private Sectors.

Scope of Solid and Hazardous Waste Management

Household hazardous wastes are products that contain ingredients that are toxic, flammable, reactive or corrosive. If disposed of improperly, these wastes can be harmful to humans, wildlife and the environment. Proper disposal prevents household hazardous waste from entering the environment; damaging soil, groundwater and streams; or causing harm to people and animals. Solid and hazardous waste management is an important area in environmental engineering which has emerged as an independent discipline to understand the fundamentals of environmental pollution and problems. The following are the objectives and core values of the subject:-

- To educate the students in the area of Solid waste and Hazardous Management and train them in the laboratory in the determination of physical, biological and chemical characteristics of different types of wastes
- Promote academic excellence.

- Raise the level of knowledge, competence and skills in the area of Environmental engineering and solid and hazardous waste management in particular.
- Implementation of new curriculum and innovative instructional methods, such as self-paced learning, problem-solving projects.
- Establish and expand research capabilities for students and faculty.
- Consulting projects that will serve industry and the community.

Pedagogy

The pedagogy will be a mixed of lectures, experience sharing, real life case discussions, assignments and industry/ research based projects. The course is based on strategic issues with cases as the primary vehicle for learning. In addition to reading materials, additional reading and cases will be distributed in the class from time to time. Students are also expected to prepare and analyze all the cases as class participation is very important.

Course requirement

i) Since much of the course material requires class lectures and discussions, it is important that you are prepared for the class, present and defend your ideas. Preparation for the class includes having read the assignment material.

ii) There will be several home assignments related to the subject and a number of unannounced quizzes. Late submissions of assignments will not be accepted and there will be no makeup quizzes.

iii) Class participation will be based on the value you add to the class through your questions, statements and comments. The quality of questions, statements and comments is more important than the quantity of these.

Evaluation Scheme

TA

Qiuzzes	: 10%
Assignments	: 10%
Class Participations	: 5%

Examination

Mid Term	: 25%
End Term	: 50%

Course Name: Advanced Environmental Engineering Laboratory

L: T: P (0-0-2) Credits- 1

Course Code: CE516/CE444 / CE514

credits
2015 batch onwards

Course Objectives:

This course is aimed to provide detailed practical knowledge and understanding the advance instrumentation methods and techniques used for analysis of different pollution. The laboratory practical provides good insight into different experimental methods relevant to Environmental Engineering. Students deal with problems relating to measuring technology and measurement inaccuracy, learn to characterise systems, and to both compare and discuss measurement results using simple models. This work is then written up in scientific reports.

Evaluation Scheme

4. Continuous assessment will be done. All the students are advised and expected to be regular in all evaluation exercises.

   The weightage for different components is as follows:

- Laboratory Assignments : 30%
- Class Participation/Presentation & Discussion : 20%
- Term-End Laboratory Exam : 50%

Session Plan (15 sessions of 180 minutes each)

- Batch Experiments related to physico-chemical processes:
  (i) Sedimentation
  (ii) Studies on Filtration
  (iii) Characteristics of filter media
- Kinetics of suspended growth process (activated sludge process)
- Kinetics of attached growth process (Rotating Biological Contactors).
- Determination of MLSS and MLVSS & Sludge volume Index in ASP
- Anaerobic Reactor systems / Kinetics
- Design and operation of treatability studies and microbial growth kineties
- Soil Analysis: pH, Conductivity, Cation exchange capacity, Sodium Adsorption ratio
- Coagulation and flocculation of water – Optimization of dose / pH / time of flocculation
- Determination of Phenol, Pesticides concentrations by GC and HPLC
- Color removal from wastewater by adsorption
- Noise measurement using SLM
- Package programmes for water and wastewater conveyance, treatment and disposal
- Use of Software's: like LOOP, SEWER, CALINE etc