UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

SYLLABUS FOR
III SEMESTER
CIVIL ENGINEERING
### SCHEME -2013

#### III SEMESTER

**CIVIL ENGINEERING (C)**

<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Credits</th>
<th>Weekly load, hours</th>
<th>C A Marks</th>
<th>Exam Duration Hrs</th>
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<tr>
<td>13.301</td>
<td>Engineering Mathematics II (ABCEFHMNPRSTU)</td>
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<td>13.302</td>
<td>Mechanics of Structures (C)</td>
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13.301 ENGINEERING MATHEMATICS - II (ABCEFHMNPRSTU)

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

Course Objective:

This course provides students a basic understanding of vector calculus, Fourier series and Fourier transforms which are very useful in many engineering fields. Partial differential equations and its applications are also introduced as a part of this course.

Module – I


Module – II


Fourier Transforms: Fourier integral theorem (no proof) –Complex form of Fourier integrals- Fourier integral representation of a function- Fourier transforms – Fourier sine and cosine transforms, inverse Fourier transforms, properties.

Module – III


Module – IV

Applications of Partial differential equations: Solution by separation of variables. One dimensional Wave and Heat equations (Derivation and solutions by separation of variables). Steady state condition in one dimensional heat equation. Boundary Value problems in one dimensional Wave and Heat Equations.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

- **Examination duration:** 3 hours  
  **Maximum Total Marks:** 100

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

At the end of the course, the students will have the basic concepts of vector analysis, Fourier series, Fourier transforms and Partial differential equations which they can use later to solve problems related to engineering fields.
13.302 MECHANICS OF STRUCTURES (C)

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

Course Objective:

To learn the principles underlying the mechanics of deformable bodies and thereby to understand the strength and physical performance of structures.

Module – I


Module – II

Introduction to analysis of beams - Concept of bending moment and shear force - Relationship connecting intensity of loading, shear force and bending moment – Shear force and bending moment diagrams for cantilever, simply supported and overhanging beams for different loadings such as point load, UDL, uniformly varying load and applied moment. Theory of simple bending – Limitations – Flexural Rigidity - Bending stress distribution in beams of different cross-sections – Moment of resistance – Beams of uniform strength

Module – III

Shear stress distribution in beams of different cross-sections. Introduction to shear centre and shear flow (concept only – no numerical examples). Theory of columns – Short columns – Direct and bending stresses in short columns - Kern of section - Pressure distribution of dams and retaining walls. Torsion of solid and hollow circular shafts – Torsion of rectangular shafts – Power transmission – Closely coiled and open coiled helical springs

Module – IV

Analysis of pin-jointed plane frames by the method of joints and sections. Strain energy – Strain energy due to normal stress, shear stress and bending stress – Instantaneous stresses and strains due to suddenly applied and impact loading. Stresses in thin cylindrical and spherical shells – stresses in thick cylindrical shells.
References:


**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests *(minimum 2)*

30% - Assignments *(minimum 2)* such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

At the end of the course, the students will be able to do the design and analysis of a huge variety of mechanical and structural systems.
Course Objectives:

- An understanding of fluid statics fundamentals, including concepts of pressure on submerged & floating bodies.
- An understanding of fluid dynamics fundamentals, including concepts of mass and momentum conservation.
- An ability to apply the fundamental theories of fluid statics and fluid dynamics to solve problems in Civil Engineering.
- An exposure to recent developments in fluid mechanics, with application to civil engineering systems.

Module – I

Fluid statics: Fluid pressure, variation of pressure in a fluid, measurement of pressure using manometers—simple manometers, differential manometers. Pressure head forces on immersed plane and curved surfaces. Pressure distribution diagram for vertical surfaces, practical application of total pressure (spillway gates).

Buoyancy and Floatation: Buoyant force, stability of floating and submerged bodies, metacentre and metacentric height, analytical and experimental determination of metacentric height.

Module – II

Kinematics of fluids: Methods of describing fluid motion, Lagrangian and Eulerian methods, Types of fluid flow: steady and unsteady flow, uniform and non-uniform flow, one, two and three-dimensional flow, laminar and turbulent flow, rotational and irrotational flow, Types of flow lines: streamline, path line, streak lines, conservation of mass, equation of continuity in one, two and three dimensions, (Derivation in Cartesian co-ordinate system) Velocity & Acceleration of fluid particle, convective and local acceleration, Deformation of fluid elements: circulation and vorticity, velocity potential, stream function, equipotential lines, flow net, uses of flow net.

Module – III

Factors influencing motion: Euler’s equation of motion and integration of Euler’s equation of motion along a streamline, Bernoulli’s Equation, Energy and Momentum correction factors, Applications of Bernoulli’s equation, Pitot tube, Venturimeter and orifice meter. Vortex motion, free and forced vortex (no problems).

Flow through orifices: Different types of orifices, Flow over a sharp edged orifice, Hydraulic coefficients – Experimental determination of these coefficients, flow through large
rectangular orifice, Flow through submerged orifices, flow under variable heads, time of emptying.

Flow over weirs: Types of weirs flow over rectangular sharp crested weir, Francis formula, Flow over a trapezoidal weir, Cipolletti weir, broad crested weir, submerged weirs, proportional weir, time of emptying through weirs.

Module – IV

Pipe flow: Major and minor energy losses, Darcy- Weisbach equation, hydraulic gradient and total energy line, pipe connecting reservoirs-pipes in series, pipes in parallel, equivalent pipe, transmission of power through pipes

Viscous flow: Laminar flow through circular pipes, Hagen Poiseuille equation, Reynolds experiment. Laminar flow between two stationary parallel plates.

Momentum equation – application to flow through pipe bends.

References:


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests *(minimum 2)*

30% - Assignments *(minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.*

20% - Regularity in the class
University Examination Pattern:

Examination duration: 3 hours  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: No charts, tables, codes are permitted in the Examination hall. If necessary relevant data shall be given along with the question paper by the question paper setter.

Course Outcome:

- Students can identify and analyse problems in Fluid mechanics related areas in Civil Engineering
- Develops an ability to solve problems in Civil Engineering using the principles of fluid mechanics
- Acquires the required knowledge for preparing designs for hydraulic structures
13.304 CONCRETE TECHNOLOGY AND ADVANCED CONSTRUCTION (C)

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

Course Objective:

- This course provides students a detailed insight into the various concrete making materials and their properties on fresh and hardened properties of concrete.
- This course also introduces students to various construction equipment and techniques.

Module – I

Cement: Manufacturing of Portland cement, Ingredients, Chemical composition, basic properties of cement compounds, Hydration of cement, heat of hydration, physical properties of Portland cements, Indian standard tests and specification, various types and grades of cement, storage of cement

Aggregates: Classification of aggregates based on size, shape, unit weight, Characteristics of aggregates – Strength of aggregate, particle shape and texture, specific gravity, bulk density, porosity, moisture content of aggregate, bulking of fine aggregate, deleterious substance in aggregate, soundness of aggregate, alkali-aggregate reaction, sieve analysis: grading curves, fineness modulus, grading requirements, grading of fine and coarse aggregates, zoning, IS tests and specification for aggregates for concrete.

Water: Quality of mixing water, effect of impurities in water on properties of concrete.

Admixtures: Functions and classification of admixtures, chemical and mineral admixtures and its effect on concrete, factors influencing the dosage of different admixtures.

Module – II

Properties of fresh concrete: Water/ Cement ratio and its significance in fresh concrete, workability - different methods for assessing workability according to IS Specification, factors affecting workability, requirements of workability for various work, segregation, bleeding, setting and hardening.


Module – III


Non-destructive testing of concrete: Rebound hammer and ultrasonic pulse velocity testing

Mix Design: Factors causing variations in the quality of concrete, statistical quality control, quality management in concrete construction, Proportioning of concrete mixes - factors influencing the choice of mix proportions, General principles of concrete mix design by IS Method, Importance of trial mixes and adjustment of ingredients of concrete.

Module – IV

Formwork for concrete: Requirements of a good formwork, Materials used for formwork – advantages and disadvantages, Formwork for beams, columns, slabs.

Coffer dam – Types

Construction equipment – excavator, bulldozer, power shovel, dumper, rollers, compactors, aggregate crushers, concrete mixtures, pile driving equipment.

Tunneling – Method of tunneling through hard rock and soft soil, drainage, ventilation, lining.

Earthquake resisting construction – Construction aspects only.

References:


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
20% - Regularity in the class
University Examination Pattern:

Examination duration: 3 hours          Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

- At the end of the course, the students will be familiar with the uses and properties of various concrete making materials and properties and testing of concrete in both fresh and hardened stages.

- The students will also be familiar with various advanced construction methods and equipment and will acquire a basic knowledge for supervising the construction of buildings.
13.305 SURVEYING – I (C)

Teaching Scheme: 4(L) - 1(T) - 0(P)  
Credits: 5

Course Objectives:

- To introduce the principle of surveying
- To impart awareness on the various fields of surveying and the types of instruments
- To understand the various methods of surveying and computations

Module – I

Principles of surveying, Classification of surveying

Linear measurement: Instruments for linear measurements- survey stations- survey lines- ranging out survey lines- chain and tape- tape corrections.

Angular measurements: Instruments for angular measurements prismatic compass bearing of survey lines, systems of bearings and conversions - variations- local attraction - declination- dip.

Graphical methods of surveying: Plane table surveying - instruments used - methods of plane table surveying. – Radiation & Intersection only – advantages & disadvantages

Module – II

Leveling: Principles of leveling- leveling instruments - booking and reduction levels – methods - simple, differential, and reciprocal leveling - profile and cross sectioning. Digital Level, errors in levelling

Contouring: Characteristics, methods, uses.

Area and Volume: Methods of computation (problems only)

Mass diagram: Construction, Characteristics and uses.

Module – III

Theodolite survey: Instruments- measurement of horizontal and vertical angle.

Tacheometric surveying: Stadia tacheometry - principles- determination of instrument constants, tangential tacheometry - principles.

Module – IV

Hydrographic Survey – Sounding –Methods of locating soundings – Three point problem – analytical method – Station pointer

Field Astronomy – Terrestrial latitude and longitude, Celestial Sphere – Astronomical triangle, Co-ordinate system
References:


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

*Part A* (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

*Part B (80 Marks)* - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: No charts, tables, codes are permitted in the Examination hall. If necessary relevant data shall be given along with the question paper by the question paper setter.

Course Outcome:

*After successful completion of the course, the students will possess knowledge on the various types of surveys, the instruments and its suitability for various purposes.*
13.306 ENGINEERING GEOLOGY (C)

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

Course Objective:

To impart the knowledge of geology in order to fulfill the geological requirements in various fields of Civil Engineering like Soil Mechanics, Rock Mechanics, Water Resources Engg, Environmental Engg, and Earthquake Engineering.

Module – I


Module – II

Definition and physical properties of minerals. Physical properties and chemical composition of quartz, feldspars (orthoclase, microcline and plagioclase), micas (biotite and muscovite), amphibole (hornblende only), pyroxene (augite and hypersthene), gypsum, calcite, dolomite, clay minerals (kaolinite only). Genetic divisions of rocks, rock cycle. Brief account of texture, structure and classifications of igneous, sedimentary and metamorphic rocks. Brief study of granite, gabbro, dolerite, basalt, sandstone, limestone, shale, gneiss, schist, slate, marble and quartzite. Rock types of Kerala. Engineering properties of rocks used as site rocks, building stones and aggregates.

Module – III


Module – IV

factor. Oceans-coastal landforms, marine erosion and coastal protection. Basic principles of
disaster management. Vulnerability assessment, Preparedness and mitigation measures for
earthquakes, floods, tsunamis, landslides and volcanoes.

References:-


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature
survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are
compulsory. There should be at least one question from each module and not more
than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each
module. Each question carries 20 marks.

Course Outcome:

Students will be benefited by the knowledge of dynamics of the earth, properties of
rocks and minerals and the occurrence and distribution of ground water and the
recent geo information technologies.
13.307 BUILDING DRAWING (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:
This course provides students an insight into detailed drawings of building components and preparation of full fledged drawing of small residential building.

Module – I

General – Study of IS codes of practice on building drawing, Symbols for various materials
Brick bond – Plan and Elevation of 1, 1½ & 2 brick wall corner in English and Flemish bond.
Footing: Isolated and combined footing
RCC lintel and sunshade – longitudinal and cross section.

Module – II

Roofing - Elevation and joint details of lean-to roof, coupled and collar roof, King post, Queen post trusses with A.C. and tile roofing – Steel (French) roof truss with AC/GI sheet roofing.
Stairs – Plan and sectional elevation of RCC dog legged stairs.
Building: Preparation of Plan Section and Elevation of small residential building from line sketch.

References:

Internal Continuous Assessment (Maximum Marks-50)

40% - Tests (minimum 2)
40% - Class work. Drawing sheets to be prepared from all topics in module I & II (minimum 10 Sheets)
20% - Regularity in the class
University Examination Pattern:

Examination duration: 3 hours  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one question out of the two from each module. Each question carries 40 marks.

Course Outcome:

At the end of the course, the students will be familiar with the various building components, method of preparing plan, section and front elevation of a residential building.
Course Objective:
- To equip the students to undertake survey using levels
- To equip the students to undertake survey using theodolites
- To impart awareness on modern levels

List of Exercises:

1. Chain Survey & Compass Survey – 1 class
2. Plane Table Survey – Radiation & Intersection 2 class
3. Levelling – H.I. and Rise and fall method 3 class
4. Theodolite survey – 6 class
   (Height & distance using Trigonometric levelling)
5. Study of instruments – Automatic level, digital level 1 class

Internal Continuous Assessment (Maximum Marks-50)
- 40% - Test
- 40% - Class work and Record
- 20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

Either Plane Table Surveying (50Marks) & Levelling (50Marks)
or Theodolite Survey (100 Marks)

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After successful completion of the course, the students will be able to undertake survey using level and theodolite.
UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

IV SEMESTER

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13.401 ENGINEERING MATHEMATICS - III (BCHMNPSU)

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

Course Objective:

- To introduce the basic notion in complex analysis such as Analytic Functions, Harmonic functions and their applications in fluid mechanics and differentiations and integration of complex functions, transformations and their applications in engineering fields.
- Numerical techniques for solving differential equations are also introduced as a part of this course.

Module – I


Conformal mapping: Conformality and properties of the transformations $w = \frac{1}{z}$, $w = z^2$, $w = Z + \frac{1}{z}$, $w = \sin z$, $w = e^z$ - Bilinear transformations.

Module – II


Evaluation of real definite integrals: $\int_{0}^{2\pi} f(\sin x, \cos x) dx$, $\int_{-\infty}^{\infty} f(x) dx$ (with no poles on the real axis). (Proof of theorems not required).

Module – III


Module – IV

Numerical integration- Trapezoidal Rule- Simpson’s one third rule.


Numerical Solution of two-dimensional partial differential equation (Laplace equation) - using finite difference method (five point formula)
References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of this course, the students will be able to use numerical methods to solve problems related to engineering fields. This course helps students to master the basic concepts of complex analysis which they can use later in their career.*
13.402 HUMANITIES (ACHPT)

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

Course Objectives:

- To explore the way in which economic forces operate in the Indian Economy.
- The subject will cover analysis of sectors, dimensions of growth, investment, inflation and the role of government will also be examined.
- The principle aim of this subject is to provide students with some basic techniques of economic analysis to understand the economic processes with particular reference to India.
- To give basic concepts of book keeping and accounting

PART I  ECONOMICS (2 periods per week)

Module – I

Definition of Economics – Central Economic Problems – Choice of techniques – Production possibility curve – Opportunity Cost - Micro & Macro Economics


Production function – Law of Variable proportion – Returns to scale – Iso-quants and Isocost line- Least cost combination of inputs – Cost concepts – Private cost and Social Cost -

Short run and Long run cost- cost curves – Revenue – Marginal, Average and Total Revenue- Break even Analysis

Module – II


**PART-II- ACCOUNTANCY** (1 Period per week)

**Module – III**


Final accounts: Preparation of trading and profit and loss Account- Balance sheet (with simple problems) - Introduction to accounting packages (Description only).

**References**


**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

*The question paper shall consist of 2 parts. Part I and Part II to be answered in separate answer books.*
Part I Economics (70 marks) – Part I shall consist of 2 parts.

Part A (20 Marks) - Ten short answer questions of 2 marks each, covering entire syllabus of Part I (five questions each from Module I and Module II). All questions are compulsory.

Part B (50 marks) - Candidates have to answer one full question out of the two from Part I (Module I and Module II). Each question carries 25 marks.

Part II Accountancy (30 marks)
Candidates have to answer two full questions out of the three from Part II (Module III). Each question carries 15 marks.

Course outcome:

- The students will be acquainted with its basic concepts, terminology, principles and assumptions of Economics.
- It will help students for optimum or best use of resources of the country.
- It helps students to use the understanding of Economics of daily life.
- The students will get acquainted with the basics of book keeping and accounting.
13.403 STRUCTURAL ANALYSIS - I (C)

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

Course Objectives:

To equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary structures.

Module – I


Module – II

Introduction to energy methods – Strain energy and complementary energy – Castigliano’s theorems - Application of theorem to statically determinate beams and rigid-jointed plane frames. Principle of virtual work and its application to statically determinate beams, rigid-jointed frames and pin-jointed frames –Clark-Maxwell’s reciprocal theorem – Betti’s theorem – Principle of minimum total potential energy.

Module – III

Arches – Behaviour and types of arches – Analysis of three hinged arches – Axial force, shear force and bending moment in circular and parabolic three hinged arches. Elastic stability of slender columns – Euler’s formula for long columns with different end conditions – Limitations of Euler’s formula – Rankine’s formula – Columns subjected to eccentric loading.

Module – IV

Moving loads and Influence lines – Influence line diagram for reactions, shear force and bending moment in simply supported and cantilever beams and overhanging beams-Moving loads – Maximum effects under distributed loads, two concentrated loads and series of concentrated loads – Absolute maximum shear force and bending moment – Shear force and bending moment envelope – Equivalent uniformly distributed load – Influence lines for member forces in statically determinate trusses. Analysis of three dimensional pin-jointed frames by the method of tension coefficients.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*The student will get a good grasp of all the fundamental issues related to Structural Analysis.*
13.404 FLUID MECHANICS - II (C)

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

Course Objective:

- Application of the Basic principles and laws governing fluid flow to open channel flow including hydraulic jump & gradually varied flow.
- An understanding of basic modeling laws in fluid mechanics and dimensional analysis.
- An ability to apply the fundamental theories of fluid mechanics for the analysis and design of hydraulic machines

Module – I

Flow in open channels-types of channels, types of flow, geometric elements of channel section, velocity distribution in open channels, uniform flow in channels, Chezy’s equation, Kutters and Bazin’s equations, Manning’s formula, Most economic section for rectangular, trapezoidal and triangular channels. Condition for maximum discharge and maximum velocity through circular channels, computations for uniform flow, normal depth, conveyance of a channel section, section factor for uniform flow.

Specific energy, critical depth, discharge diagram, Computation of critical flow, Section factor for critical flow. Specific force, conjugate or sequent depths, hydraulic jump, expression for sequent depths and energy loss for a hydraulic jump in horizontal rectangular channels, types of jump, length of jump, height of jump, uses of hydraulic jump.

Module – II

Gradually varied flow - dynamic equation for gradually varied flow, different forms of dynamic equation, classification of surface profiles, Backwater and drawdown curves, characteristics of surface profiles in prismatic channels. Computation of length of surface profiles, direct step method.

Surges in open channel flow - Classification- positive surges moving upstream - positive surges moving downstream, negative surges moving upstream - negative surges moving downstream, problems from positive surges.

Module – III

Boundary layer theory-no slip condition, boundary layer thickness, boundary layer growth over long thin plate, laminar, turbulent boundary layer, laminar sub layer, Momentum integral equation of boundary layer (no derivation), Blasius boundary layer equations for
laminar and turbulent boundary layer, computation of drag on a flat plate. Separation of boundary layer and control.

Dimensional analysis and model studies - dimensions, dimensional homogeneity, methods of dimensional analysis, Rayleigh method, Buckingham method, dimensionless numbers, Similitude - geometric, kinematic and dynamic similarities. Model laws - Reynold’s and Froude model laws, scale ratios, types of models, distorted and undistorted models, scale effect in models.

Module – IV

Hydraulic Machines - Impulse momentum principle, impact of jets, force of a jet on fixed and moving vanes. Turbines- classification and comparison of velocity triangles for Pelton wheel and reaction turbines (Francis and Kaplan), work done and efficiency, specific speed, draft tube- different types, penstock, surge tank - types, cavitation in turbines.

Pumps- classification of pumps - Centrifugal pumps- types, work done, efficiency, minimum speed, velocity triangle for pumps, specific speed, priming, limitation of suction lift, net positive suction head, cavitation in centrifugal pump.

References:


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class
University Examination Pattern:

Examination duration: 3 hours  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: No charts, tables, codes are permitted in the Examination hall. If necessary, relevant data shall be given along with the question paper by the question paper setter.

Course Outcome:

- The students become capable of analysis of open channel flows & design of open channels.
- They get an insight into the working of hydraulic machines.
- They become capable of studying advanced topics such as design of hydraulic structures.
13.405 SURVEYING - II (C)

Teaching Scheme: 4(L) - 1(T) - 0(P)  
Credits: 5

Course Objectives:

- To impart awareness on the advanced surveying techniques.
- To understand the errors associated with survey measurements.
- To provide a basic understanding on geospatial data acquisition and its process.

Module – I

**Triangulation** - Triangulation figures, Strength of figure, Triangulation stations, intervisibility of stations - Towers and signals, Satellite Stations and reduction to centre.

**Theory of errors** – Types, theory of least squares, weighting of observations, most probable value, application of weighting, computation of indirectly observed quantities, Method of normal equations, conditioned quantities.

Module – II

**Traverse Surveying** - Methods of traversing, Checks in closed traverse, Traverse computations, balancing the traverse

**Curves** - Elements of simple and compound curves, Method of setting out, Elements of Reverse curve (Introduction only), Transition curve, length of curve, Elements of transition curve, Vertical curve, types, Length of vertical curve.

Module – III

**Electromagnetic distance measurement (EDM)** - Principle of EDM, Modulation, Types of EDM instruments, Distomat.

**Total Station** - Parts of a Total Station, Accessories, On Board calculation, Field Procedure, Errors in Total Station Survey, Good Practices in Using Total Station, Advantages of Using Total Station. **GPS** – Components, principles, applications.

Module – IV

**Photogrammetry** - Terrestrial and Aerial photogrammetry, Heights and distances from photographic measurement, Flight planning, Vertical Photograph, Geometry and scale of vertical photographs, Ground coordinates from vertical photographs, Relief displacement, Stereoscopy and parallax

**Remote Sensing** - Electromagnetic Spectrum, Energy interaction with the Earth, Types of Remote sensing, Advantages, Applications

**Geographic Information System** - Components of GIS, GIS Data, Database Management Systems (DBMs).
References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** No charts, tables, codes are permitted in the Examination hall. If necessary, relevant data shall be given along with the question paper by the question paper setter.

**Course Outcome:**

After successful completion of the course, the students will possess knowledge on the advanced methods of surveying, the instruments, and the spatial representation of data.
Course Objective:

- To familiarize the students to various building planning aspects, standards & rules.
- To equip the students to prepare quantity estimation of general items for simple buildings.
- To train the students how to prepare working drawings of various types of buildings.

Module – I


Module – II

Computation of Plinth Area, Carpet Area, Covered Area ratio, Floor Area Ratio, Computation of storage capacity of rain water harvesting system as per norms,


Module – III

Preparation of working drawings (from line sketches or from specifications) of different types of buildings namely,

1. Single storeyed buildings with flat roof, pitched roof and partly pitched and partly flat roof
2. Two–storeyed and multi–storeyed buildings
3. Public utility buildings like hostel, hospital, library etc. and
4. Industrial building.
5. Preparation of lay- out plan of house drainage for a given building.
6. Preparation of site plans and service plans as per building rules.

Note 1: The student should know the local (Panchayath/Corporation) building rules and should be in a position to prepare sketch design for clients and submission drawing for approval. As a term paper, at the end of the semester, each student should design and prepare a submission drawing for a proposed residential building.

Note 2: Minimum 10 sheets must be drawn.
References:-


Internal Continuous Assessment (Maximum Marks-50)

40% - Tests (minimum 2)
40% - Class work. (75% weightage should be given to the 10 drawings prepared and 25% weightage should be given to the term paper mentioned in Note1)
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each from Modules I and II. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question from Modules I and II carries 20 marks. The questions from Module III shall be to prepare a drawing and carries 40 marks.

Course Outcome:

- The students will be aware of the general planning aspects and building rules and will be capable of planning buildings.
- The students will be capable of estimating the quantities required for construction of a building.
- The capability of reading a drawing, generating sections, preparing detailed drawings to be submitted to the sanctioning authority will be imparted to the students.
Course Objective:

- To demonstrate the basic principles and important concepts in the area of strength and mechanics of materials and structural analysis to the students through a series of experiments.

List of Experiments:

1. Tension Test on MS and HYS D bars
2. Shear test on MS Rod
3. Torsion test on MS Rod
4. Toughness test (Izod and Charpy Impact tests)
5. Hardness test (Brinell and Rockwell Hardness tests)
6. Spring test – Open and closed coiled springs (Determination of spring stiffness and modulus of rigidity)
7. Bending test on wooden beams
8. Verification of Maxwell’s Reciprocal theorem (Deflection test on timber and steel beams)
9. Determination of modulus of rigidity of wires using Torsion Pendulum

Internal Continuous Assessment (Maximum Marks-50)

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

Questions based on the list of experiments prescribed.

80% - Procedure, conducting experiment, results, tabulation and inference
20% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

This subject will lay foundation to the study of subjects viz. strength of materials and mechanics of materials. It also provides students a feel for how various engineering properties of materials are applied in engineering practice.
13. 408 FLUID MECHANICS LABORATORY (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:

- Getting practical experience in flow measuring devices, gauges, valves and various components used for house plumbing.
- Acquire practical knowledge and verify the theories learned in Courses on Fluid Mechanics (13.303 & 13.404).

Pre requisites:

Basic Knowledge of Fluid Mechanics (13.303)

Part I: Preliminary study:

1. Flow measuring equipments - water meters, current meters, venturi meter, orifice meter and manometers
2. Gauges and valves - pressure gauge, vacuum gauge, stop valve, gate valve and foot valve.
3. Pumps - centrifugal and reciprocating type. (Description with layout)
4. Turbines - impulse and reaction types. (Pelton and Francis) (Description with layout)

Part II: List of Experiments:

1. Determination of Darcy’s coefficient and Chezy’s constant on pipe friction apparatus.
2. Coefficient of discharge and calibration of
   a) Notches
   b) Venturi meters
   c) Orifice meters.
4. Performance test [specific speed, economic running cost] on
   a) Centrifugal pumps
   b) Reciprocating pumps

Internal Continuous Assessment (Maximum Marks-50)

40% - Test
40% - Class work and Record
20% - Regularity in the class
University Examination Pattern:

Examination duration: 3 hours  Maximum Total Marks: 100
Questions based on the list of experiments prescribed in Part II.
80% - Theory, Procedure and tabular column (30%);
   Conducting experiment, Observation, Tabulation with Sample calculation (30%) 
   Graphs, Results and inference (20%)
20% - Viva voce (Based on Part I and Part II)
Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

- The students gain practical experience of performances of flow devices and machines.
- The acquired knowledge would help the students in planning and executing civil engineering projects, and while supervising plumbing work.
<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Credits</th>
<th>Weekly load, hours</th>
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<td>Engineering Mathematics - IV (BCHMPSU)</td>
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<td>Structural Analysis II (C)</td>
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<td>Water Resources Engineering (C)</td>
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<td>Practical Surveying II (C)</td>
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<td>13.508</td>
<td>Concrete Lab. (C)</td>
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Course Objective:

- To provide a basic understanding of random variables and probability distributions.
- Mathematical programming techniques are introduced as a part of this course. These techniques are concerned with the allotment of available resources so as to minimize cost or maximize profit subject to prescribed restrictions.

Module – I

Random Variables - Discrete and continuous random variables and their probability distributions - Probability distribution (density) functions - Distribution functions - mean and variance - simple problems - Binomial distribution, Poisson distribution, Poisson approximation to Binomial, Uniform distribution, Exponential Distribution, Normal distribution - mean and variance of the above distributions (derivations except for normal distribution) - Computing probabilities using the above distributions.

Module – II

Curve fitting - Principle of least squares - Fitting a straight line – Fitting a parabola - Linear correlation and regression - Karl Pearson’s coefficient of correlation - Sampling distributions - Standard error - Estimation - Interval estimation of population mean and proportions (small and large samples) - Testing of hypothesis - Hypothesis concerning mean - Equality of means - Hypothesis concerning proportions - Equality of proportions.

Module – III


Module – IV


References:


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of this course, the students will be familiar with the large scale applications of linear programming techniques which require only a few minutes on the computer. Also they will be familiar with the concepts of probability distributions which are essential in transportation engineering.*
13.502 ENVIRONMENTAL ENGINEERING – I (C)

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

Course Objectives:

- **At the first phase of the course delivery, student will obtain primary understanding about the suspended and colloidal impurities in drinking water and the procedure for removing it**
- **In the second phase, student will identify the significance of filtration, disinfection, systems of distribution of water and develop an idea about the functioning of all units of a conventional water treatment plant**
- **In the third phase of course delivery, student will identify how the water demand of a community is scientifically assessed and distribution systems and its capacities were designed**
- **In the last phase, student will obtain additional information on the advanced water treatment techniques including the removal of inorganic impurities from drinking water**

**Module – I**


**Module – II**


**Module – III**

Quantification of water demand for a community through population forecasting – Factors affecting consumption-Fluctuations in demand- mass curve-capacity of service reservoirs-River intakes- pumps-design of pumping capacity-nomograms-design of water mains-Hardy-cross method-applications.

**Module – IV**

References


Internal Continuous Assessment *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

*After successful completion of the course, the students will be able to:*

- Analyze and understand main issues related to drinking water pollution and its management
- Explain, evaluate and design various units of a typical water treatment plant
- Outline the programmes, procedures for treatment and distribution of drinking water to community
- Develop an understanding on the advanced water treatment techniques
13.503 STRUCTURAL ANALYSIS - II (C)

**Teaching Scheme:** 4(L) - 1(T) - 0(P)  
**Credits:** 5

**Course Objectives:**

> To give an in depth idea regarding the analysis of indeterminate structures and also to give an idea about structural dynamics.

**Module – I**

Concept of static indeterminacy and their determination in beams, rigid-jointed frames and pin-jointed frames - Analysis of fixed beams by moment-area method – Effect of rotation and settlement of supports - Analysis of continuous beams by the theorem of three moments – Effect of settlement of supports.


**Module – II**

Müller-Breslau principle, Influence lines for statically indeterminate structures, Influence line diagrams for various force components in propped cantilever and two span continuous beams.


**Module – III**

Moment Distribution method for beams and rigid jointed plane frames (with and without sway) – Effect of support settlement – Kani’s method for beams and rigid jointed plane frames of different geometry (with and without sway).

**Module – IV**

References:


Internal Continuous Assessment *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*The students after undergoing this course will be able to analyse all types of structural systems.*
13.504 GEOTECHNICAL ENGINEERING – I (C)

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

Course Objective:

- To impart to the students, the fundamentals of Soil Mechanics;
- To enable the students to acquire proper knowledge about the basic, index and engineering properties of soils.

Module – I

Soil formation - Major soil deposits of India - Basic soil properties - Weight-volume relationships - Void ratio, porosity, degree of saturation, air content, percentage air voids, moisture content, specific gravity, bulk, saturated and submerged unit weights - Relationship between basic soil properties. Index properties - Sieve analysis – Well graded, poorly graded and gap graded soils - Stoke’s law - Hydrometer analysis – Relative density – Consistency - Atterberg Limits - Practical Applications - I.S. classification of soils.

Module – II


Module – III

Compressibility and Consolidation - Void ratio versus pressure relationship - Coefficient of compressibility and volume compressibility – Compression index - Change in void ratio method - Height of solids method - Normally consolidated, under consolidated and over consolidated states - Estimation of pre consolidation pressure - Estimation of magnitude of settlement of normally consolidated clays – Terzaghi’s theory of one-dimensional consolidation(no derivation required) - average degree of consolidation – Time factor - Coefficient of consolidation - Square root of time and logarithm of time fitting methods.

Module – IV

Shear strength of soils- Mohr-Coulomb failure criterion - Direct shear test, tri-axial compression test, vane shear test, unconfined compression test - Applicability - UU and CD
tests [Brief discussion only] - Sensitivity - Thixotropy - Liquefaction - Critical void ratio
Stability of finite slopes - Toe failure, base failure, slip failure - Swedish Circle Method –
Friction circle method – Factor of safety with respect to cohesion and angle of internal
friction - Stability number - Stability charts - Methods to improve slope stability.

References:

2002.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature
survey, seminar, term-project etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are
compulsory. There should be at least one question from each module and not more
than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each
module. Each question carries 20 marks.

Note: Use of Taylor’s stability chart is permitted in the Examination hall. Any other
relevant data, if necessary, shall be given along with the question paper by the
question paper setter.

Course Outcome:

The students understand the basic principles governing soil behaviour; they
understand the procedure, applicability and limitations of various soil testing
methods.
Course Objectives:
- To impart knowledge in planning and design of railway tracks, rails, sleepers, points and crossings, track junctions, signals, control systems, stations and yards.
- To make the students aware of features and planning of harbour and harbour structures.

Module – I
Introduction-Classification of transport modes-Rule of Indian railways in the National development-Railways for Urban transportation-Light Rail Transit (LRT) and Mass Rapid Transit(MRT) system.


Rail fixtures and fasteners - Purpose and types - Modern elastic fastenings.

Sleepers-Functions-Requirements-Types-Sleeper density.

Ballast - Functions-Requirements-Types - Ballastless tracks.

Module – II
Geometric design of tracks-Necessity-Gradients-Grade Compensation on Curves-Radius and degree of a curve-Superelevation-Cant deficiency-Equilibrium speed-Safe speed on curves-Negative Superelevation-Necessity of providing transition curve-Length of transition curve-Widening of gauges on curves

Traction and tractive resistances-Comparison of tractions-Tractive resistances-Train resistances-Resistances due to track profile--Resistances due to starting and acceleration-Wind Resistance-Hauling capacity of a locomotive-Tractive effort of a locomotive-Problems.

Module – III
Points and Crossings-Necessity-Left and Right hand Turnouts-Switches-Types-Crossings Design of turnouts

Track junctions-Types. -Design of crossovers between parallel tracks-Design of diamond crossing.
Signalling - Objectives-Classification and characteristics.

Control systems of train movement-ATC, CTC only-Track Circuiting-Interlocking of signals and points-Necessity

Stations and yards-Layout of railway stations and yard, platforms, loops, sidings-passenger yards-level crossings.

Modern trends in railways-Modernisation of traction, track, trends in track vehicles(general awareness only).

Module – IV

Harbours-Classification-Requirements of Commercial harbour-Typical layout with general features-Factors controlling harbour size-Location and width of entrance-Stevenson's formula for entrance width-Depth of harbour and approach channel-Shape of harbour

Meteorological phenomena -Wind, tides, Waves - wave parameters – fetch - Characteristics of wave-Stevenson's formula-wave action-Coastal currents-Littoral drift.

Breakwater -Classification-Methods of construction-Methods of protection-Forces acting on wall type breakwater

Marine facilities - Wharf, pier, fenders, dolphins, aprons, transit shed, warehouse, Docks-Wet dock, Dry dock - Fixed and floating, lock gates.

Containerisation-Advantages-Planning of Container terminal.

Navigational Aids-Beacons-Buoys-Lighthouse-Lightships.

Moorings-Offshore moorings.

Dredging-Types-Choice of dredger

References:

**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests *(minimum 2)*

30% - Assignments *(minimum 2)* such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** No charts, tables, codes are permitted in the Examination hall. If necessary, relevant data shall be given along with the question paper by the question paper setter.

**Course Outcome:**

- After successful completion of the course, the students will possess knowledge on features of railway and harbour structures and shall be confident to take up the planning and design of various infrastructure components of railway and harbour structures.
13.506 WATER RESOURCES ENGINEERING (C)

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

Course Objective:

- To give an idea regarding the availability of water on earth from various sources.
- To study the path of a drop of water as it starts from cloud and reaches the agricultural fields.

Module – I

Hydrology-Hydrologic cycle - Precipitation types, forms, measurements-Computation of mean precipitation- -rain gauge density and optimum number of rain gauges-water losses-Infiltration-measurement by double ring infiltrometer- Horton’s equation- infiltration indices.
Evaporation,-measurement by IMD Land pan. Runoff- Computation of runoff by different methods. Hydrograph (Sherman), Unit hydrograph and its applications-S- hydrograph.

Module – II

Planning of irrigation schemes-types of irrigation-lift and flow irrigation-Mode of irrigation water application-duty of water-soil water plant relationships-consumptive use (methods of estimation not required).-depth and frequency of irrigation water application-irrigation efficiencies.
Irrigation canals-types-canal alignment- Typical cross sections of unlined canals-Balancing depth. Design of canals on alluvial soils based on Kennedy’s theory and Lacey’s silt theory-canal lining-design of lined canals-Economics of canal lining.

Module – III

Groundwater –vertical distribution of groundwater-Types of aquifer-Aquifer properties-Darcy’s law-Steady radial flow to a well-unconfined and confined aquifers-Types of wells-open well, artesian well and tube well-Estimation of yield of an open well-Pumping test and recuperation tests-Types of tube wells (only description, no design).

Module – IV

River Engineering-meandering-river training –objectives, classification, river training methods-levees, guide banks, groynes, artificial cut-offs, pitching, pitched islands (Design not necessary).
Stream flow measurement- velocity measurements-Computation of discharge (Area-velocity method)-rating curve (stage-discharge curve).
Reservoir—various types—zones of storage—storage capacity and yield—analytical and mass curve method—reservoir sedimentation—control of sedimentation—useful life of reservoir—computation.

References:


**Internal Continuous Assessment** *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*Students become able to analyse and interpret hydrological data. They get an idea regarding the occurrence distribution and disposal of water on earth’s surface.*
13.507 PRACTICAL SURVEYING - II (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:
- To equip the students to undertake survey using tacheometer
- To equip the students to undertake survey using total station
- To impart awareness on distomat and handheld GPS

List of Exercises:

PART A
1. Tangential and Stadia Tacheometry - 4 classes
2. Three Point Problem (using Theodolite) - 1 class
3. Total Station survey - 5 classes
   i. Heights and Distance
   ii. Calculation of area
   iii. Verticality of tower

PART B
4. Setting out of Simple Curve - 1 class
5. Distomat – Measurement of distance - 1 class
6. Survey using Handheld GPS - 1 class

Internal Continuous Assessment (Maximum Marks-50)
- 40% - Test
- 40% - Class work and Record
- 20% - Regularity in the class

University Examination Pattern:
Examination duration: 3 hours  
Maximum Total Marks: 100

Questions based on the list of experiments prescribed in Part A.
Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:
After successful completion of the course, the students will be able to undertake survey using theodolite and shall be able to use modern survey instruments.
13. 508 CONCRETE LABORATORY (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:

- Getting practical knowledge in testing of construction materials
- Create awareness of the standards, specification and methods of testing of construction materials.
- Acquire practical experience in Concrete construction and quality control of construction materials.

Pre requisites:

Basic Knowledge of 1) Building Technology (13.106)
2) Concrete Technology & Advanced Construction (13.304)

List of Experiments:

1. Tests on cement
   a) Standard consistency of cement
   b) Initial and final setting time of cement
   c) Compressive strength of cement mortar
   d) Fineness of cement

2. Tests on aggregates (Fine aggregate & coarse aggregate)
   a) Particle size distribution and grading
   b) Fineness modulus, bulk density, void ratio and porosity
   c) Bulking of fine aggregate
   d) Specific gravity of aggregate

3. Tests on fresh concrete
   a) Slump test
   b) Compacting factor test
   c) Vee- bee test (Demonstration only)
   d) Flow test (Demonstration only)

4. Tests on hardened concrete
   a) Compressive strength of concrete
   b) Modulus of elasticity of concrete
   c) Flexural and split tensile strength of concrete
   d) Rebound hammer test (To be conducted on 150mm cubes)
5. **Tests on bricks, blocks and tiles**
   
   a) Compressive strength of burnt bricks
   
   b) Water absorption tests on bricks
   
   c) Transverse strength test on tiles (M P tiles and mosaic tiles)
   
   d) Compressive strength of Solid/hollow blocks (Demonstration only)

**Note:** The relevant IS Codes on methods of testing should be adopted for the above tests.

**Internal Continuous Assessment** *(Maximum Marks-50)*

- 40% - Test
- 40% - Class work and Record
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

- Questions based on the list of experiments prescribed.
- 80% - Theory, Procedure and tabular column (30%);
  
  Conducting experiment, Observation, Tabulation with Sample calculation (30%)
  
  Graphs, Results and inference (20%)

- 20% - *Viva voce*

*Candidate shall submit the certified fair record for endorsement by the external examiner.*

**Course Outcome:**

- *The students will become capable of supervising general concrete construction works.*

- *The understanding of quality control methods to be adopted in the construction site and capability of ensuring required standards will be acquired.*
UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

VI SEMESTER

CIVIL ENGINEERING
<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Credits</th>
<th>Weekly load, hours</th>
<th>CA Marks</th>
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13.601 DESIGN OF HYDRAULIC STRUCTURES (C)

Teaching Scheme: 3(L) - 0(T) - 2(P) Credit: 5

Course Objectives:

- To impart knowledge regarding the design of the various irrigation structures.
- To give an idea of causes of failure, design criteria and stability analysis of different types of dams.

Module – I

Dams-Gravity dams, arch dams, buttress dam, forces acting on dam-theoretical and practical profiles of gravity dam-low dam, high dam-stability of dam-stress in elementary profile of gravity dam. Function of shafts, galleries, keys and water seal. Arch dams-types, forces acting-design methods (Thin cylinder theory only)-Earth dam-Types-criteria for safe design-causes of failure. Spillways-Different types (Design not necessary).

Module – II

Diversion head works, layout, functions of components- causes of failure of weirs on permeable soils- Bligh’s theory-design of vertical drop weir-Khosla’s theory of independent variables-use of Khosla’s charts and Blench curves. Cross drainage works-different types-Canal falls-classification (brief description only).

Module – III

Design and drawing emphasizing the hydraulic aspects of the following structures:

1. Aqueduct
2. Syphon aqueduct
3. Canal Syphon-Design of Transition by water surface profile computation
4. Notch type canal fall
5. Sarda type fall- High discharge only –Design of floor by Khosla’s theory
6. Cross regulator (Khosla’s theory).

References:


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, drawings, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 4 hours  Maximum Total Marks: 100

The question paper shall consist of 3 parts.

**Part A (20 marks)** - From Module I and Module II. Five Short answer questions of 4 marks each. There should be at least two question from each module and not more than three questions from any module. All questions are compulsory.

**Part B (20 Marks)** - Candidates have to answer one full question out of the two each from Module I and II. Each question carries 10 marks.

**Part C (60 Marks)** - Candidates have to answer one full question out of the two from Module III. Each question carries 60 marks. The question consists of design and drawing part. In the drawing part, the questions shall be to draw maximum two views.

**Note:** Use of Khosla’s chart, Blench curves and Montague curves are permitted in examination halls.

**Course Outcome:**

After successful completion of this course, the students will be able to

- Perform the stability analysis of gravity dams
- Explain the causes of failure of different types of dams and their design criteria
- Design minor irrigation structures and prepare the detailed drawings of the same.
13.602 DESIGN OF REINFORCED CONCRETE STRUCTURES (C)

Teaching Scheme: 3(L) - 2(T) - 0(P)  
Credits: 5

Course Objectives:

- To introduce the various design philosophies.
- To impart knowledge about the fundamentals of analysis and design of RCC members.
- To develop fundamental knowledge in Pre stress concrete

Module – I


Module – II


Module – III

Columns-Interactions curves- Design of short columns with axial loads, uniaxial moment and biaxial moments- Use of SP–16 Charts- Design of long column (Brief description only). Footings- Design of Isolated footings- axial and eccentric loading- Design of Combined footings- rectangular and trapezoidal footings.

Module – IV

Pre-stressed Concrete – General principles- systems of pre stressing- Losses in Pre stress. Analysis of pre stressed beams of rectangular and symmetrical I sections, slabs.

References:

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours                           Maximum Total Marks: 100

Use of IS 456, IS 1343and Interaction curves for columns are permitted in examination halls.

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

The students after undergoing this course will have

- Capability to design structural members using relevant IS codes and SP16.
- Ability to analyse the strength of structural elements.
- Ability to analyse the Pre stress concrete symmetrical sections using relevant IS Codes.
13.603 ENVIRONMENTAL ENGINEERING – II (C)

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

Course Objectives:

- To impart basic knowledge about the types of impurities in waste water and its quantification, sewer design and sewer appurtenances
- To convey the theory of self purification of water bodies and develop an idea of theoretical calculations related to dilution method of waste water disposal
- To communicate the importance of waste water treatment and the design procedure of various waste water treatment units
- To convey the information about the treatment/disposal techniques of sludge and the introductory knowledge on house drainage and plumbing systems.

Module – I

Waste water - Sources, Quantity-Characteristics- systems of Sewerage, Types of sewers- Design of circular sewers Sewer appurtenances-Man holes, Catch basin, flushing devices, Inverted siphon, Grease and oil traps.

Module – II


Unit operations and processes for Waste water treatment- Treatment of sewage- Preliminary-Theory and design of Screen and Grit chamber, Detritus chamber, Skimming tank.

Module – III

Primary treatment-Sedimentation tank, Secondary treatment-Contact bed, Intermittent sand filter, Trickling filter, Activated sludge process, Design of Trickling filter (High rate, standard), Septic tank and its effluent disposal - Imhoff tank.

Module – IV


References


**Internal Continuous Assessment** *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course outcome:**

After successful completion of the course, the students will be able to:

- Explain the methods of analysis of waste water and the basic features of different sewer appurtenances.
- Understand the main issues related to water pollution and analyse/explain self purification in water bodies.
- Explain and design various units of a typical waste water treatment plant.
- Develop the procedures for treatment of sludge generated in a waste water treatment plant.
Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objective:

- To impart to the students, in-depth knowledge about the basic concepts and theories in foundation engineering
- To enable the students to acquire proper knowledge about various methods of foundation analysis for different practical situations.

Module – I


Module – II

Combined footings- Rectangular and Trapezoidal combined footings – Raft foundations - Allowable Bearing capacity of Rafts on sands and clays - Floating foundation. Lateral earth pressure – At-rest, active and passive earth pressures – Practical examples - Rankine’s and Coulomb’ theories[no derivation required] – Comparison - Influence of surcharge, inclined backfill and water table on earth pressure - Earth pressure on retaining walls with layered backfill.

Module – III

Stresses in soil due to loaded areas - Boussinesq’s and Westergaard’s formulae for point loads – assumptions [no derivation required] – Comments - Vertical stress beneath loaded areas of strip, rectangular and circular shapes - Newmark’s chart - Isobars- Pressure bulbs. Brief introduction to site investigation –Objectives - Guidelines for choosing spacing and depth of borings [brief discussion only] - Auger boring and wash boring methods - Standard Penetration Test – procedure, corrections and correlations.

Module – IV

Pile foundations - Point bearing and friction piles - Bearing capacity of single pile in clay and sand[I.S. Static formulae] - Dynamic formulae(Modified Hiley formulae only) - I.S. Pile load test [conventional]- Negative skin friction - Group action –Group efficiency - Capacity of Pile groups. Elements of a well foundation – Problems encountered in well sinking – Methods to
rectify tilts and shifts - Brief introduction to Machine foundation – Mass spring model for undamped free vibrations - Natural frequency – Coefficient of uniform elastic compression – Methods of vibration isolation.

References:

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Use of Tables showing bearing capacity factors, shape factors, depth factors and inclination factors as per I.S. 6403-1981, and Terzaghi’ bearing capacity factors are permitted in the Examination hall. Any other relevant data, if necessary, shall be given along with the question paper by the question paper setter.

Course Outcome:

After successful completion of the course, the students will be able to:

- understand the basic concepts, theories and methods of analysis in foundation engineering.
- assess field problems related to geotechnical engineering and take appropriate decisions.
Course Objectives:

-To give the students a basic understanding of the various geometric design elements of highways, highway materials, their test procedures and specifications, design and construction of roads, planning and design of various features of Airport.

HIGHWAY ENGINEERING

Module – I


Module – II

Classification of transport technologies-inter modal co-ordination - ITS and automated highways.
Highway drainage- Importance, surface and sub surface drainage systems. Geometric Design: Design controls and criteria, design speed, camber, sight distance, super elevation, widening of pavements on curves, horizontal curves, transition curve, gradient- vertical curves.

Module – III

Pavement Design- types of pavement structures, Design of flexible pavements IRC method. Westergaard’s analysis of wheel load stresses and temperature stresses in rigid pavements.

AIRPORTS

Module – IV

Planning and Design of Airports- Aircraft characteristics which affect planning and design of airports- Airport site selection. Runway Design- Orientation, Wind rose diagram-Basic runway length computation, correction due to elevation, Temperature and gradient, runway geometric design features, Taxiway design requirements, Terminal building, facilities required in a terminal building. Apron: Size and gate positions-parking configurations, parking system.
Typical airport layouts- Runway configurations.  Airport Landing Aids- Airport markings-Airport lighting- Air traffic control aids- landing Aids- ILS.

References:

**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.  
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks) -** Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks) -** Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** No charts, tables, codes are permitted in the Examination hall. If necessary, relevant data shall be given along with the question paper by the question paper setter.

**Course Outcome:**

After successful completion of the course, the students will have a basic understanding of the design features of highways and airport which will help them to be more technically sound.
13.606 COMPUTER PROGRAMMING AND NUMERICAL METHODS (C)

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

Course Objective:

- To provide adequate knowledge for writing programs using C++ language
- To develop C++ programmes to implement different computational methods used for the solution of engineering problems.

Module – I

Introduction to computers-computer organisation-input output devices-secondary storage devices- programming languages- Computer programming- Elements of C++ programming language – Character set, tokens, data types, variables, key words and identifiers-Input & Output, operators, expressions. Selection statements – if, switch statements.

Module – II

Looping statements - for, while, do-while statements, Jump statements – break, continue, goto exit(). Arrays - single and multi-dimensional arrays, initializing array elements, pointers & arrays, Character arrays, string functions, Unformatted console I/O functions, Unformatted Stream I/O functions.

Module – III

User defined functions – Arguments, return values, call by value, call by reference, functions calling functions, functions and arrays - Global variables, automatic, static and register variables, recursive functions, Structures - functions and structures - Arrays of structures - structures within structures, Structures containing arrays. Files - Input & Output, sequential & random access.

Module – IV

Numerical methods:
Roots of transcendental equations - method of bisection and Newton-Raphson method,
Numerical Integration - Trapezoidal and Simpson’s rule, Solution of simultaneous linear equations using Gauss elimination method.

Write programs for the following:

1. To solve non-linear equations by method of bisection and Newton-Raphson method.
2. To implement numerical integration using Trapezoidal rule and Simpson’s 1/3 rule
3. To solve general system of linear algebraic equations by Gauss elimination
References:


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks. Question from Module IV must be a programming exercise.

Course Outcome:

- Students get confidence in writing their own programs.
- Their logical thinking capacity will be developed.
- They are able to solve problems easily using computers.
13.607 TRANSPORTATION ENGINEERING LAB (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:
- To achieve practical experience in testing of Pavement Materials
- To get familiar with standard quality laboratory testing procedures for determining the basic properties and engineering behaviour of soil, aggregates and bitumen

List of Experiments:
1. Tests on Aggregates
   (i) Crushing Value
   (ii) Los-Angeles Abrasion Value
   (iii) Impact Value
   (iv) Specific Gravity
   (v) Water Absorption
   (vi) Shape Test – Flakiness Index, Elongation Index & Angularity Number

2. Tests on Bitumen
   (i) Viscosity Test with Brookfield viscometer
   (ii) Ductility Test
   (iii) Softening Point Test
   (iv) Specific Gravity
   (v) Flash Point Test

3. Tests on Soil
   (i) Modified Proctor Compaction Test
   (ii) CBR Test

Internal Continuous Assessment (Maximum Marks-50)
40% - Test
40% - Class work and Record
20% - Regularity in the class

Reference:
University Examination Pattern:

Examination duration: 3 hours  Maximum Total Marks: 100

Questions based on the list of experiments prescribed.

80% - Theory, Procedure and tabular column (30%);
   Conducting experiment, Observation, Tabulation with Sample calculation (30%)
   Graphs, Results and inference (20%)

20% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After successful completion of the course, the students will be

- Able to assess the basic and engineering properties of pavement materials.
- Capable of conducting specific tests required for field application and draw necessary inferences.
13. 608 COMPUTER AIDED DESIGN AND DRAFTING LAB (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:

- To develop an ability to use CAD software for generating engineering drawings and, perform structural analysis & design using spreadsheets and softwares.

List of Exercises:

1. Preparation of Civil Engineering Drawings – plan, section and elevation of buildings.

2. Application of spreadsheets in Civil Engineering:
   (i) BM and SF diagrams of cantilever, simply supported and overhanging beams.
   (ii) Analysis of continuous beams by moment distribution method.
   (iii) Design of singly/doubly reinforced sections by limit state method.

3. Use of structural analysis software: Analysis of cantilever and simply supported beams (Not to be included for examination)

4. Application of GIS in Civil Engineering – preparation of database and GIS analysis. (Not to be included for examination)

Note:
1. Any standard software packages can be used for drafting, spreadsheet, structural analysis and GIS.
2. The printouts of the drawings and spreadsheets/structural analysis software should be attached in the lab record maintained by the students.

References:

The manuals of the software packages used.

Internal Continuous Assessment (Maximum Marks-50)

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours  
Maximum Total Marks: 100

Questions based on the list of exercises prescribed in sections 1 and 2. Question on Civil Engineering Drawing is compulsory. Question paper may contain a question on CAD drawing and a Spread sheet analysis using software. 60% credit may be given for CAD drawing and 40% for spreadsheet analysis.
Marks should be awarded as follows:

40% - Working/Correctness of the procedure/equations (for spreadsheet analysis)
60% - Output/Results

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

- The students after undergoing this course will be able to develop engineering drawings of residential buildings using CAD software, generate spreadsheets for analysis and design of beams and use structural analysis and GIS softwares.
UNIVERSITY OF KERALA

B. TECH.  DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

VII SEMESTER

CIVIL ENGINEERING
## SCHEME -2013

### VII SEMESTER

#### CIVIL ENGINEERING (C)

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<th>Name of subject</th>
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<td>Mechanics of Composite Materials (C)</td>
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<td>Optimization Techniques in Engineering (C)</td>
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<td>Design of Offshore Structures (C)</td>
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13.701 DESIGN OF STEEL STRUCTURES (C)

Teaching Scheme: 3(L) - 2(T) - 0(P)  
Credits: 5

Course Objectives:

- To introduce steel as a structural material and various design philosophies applicable to steel structures.
- To impart knowledge about the fundamentals of analysis and design of steel structural members.
- To develop fundamental knowledge in plastic analysis of steel structures.

Module – I

Properties of structural steel, Structural steel sections, Limit state and working stress design concepts, Types of connections - Design of welded and bolted connections, design of bolted connections using high strength friction grip bolts.

Design of tension members and their connections, Lug angle connection design. Design of struts (single angle and double angle sections).

Module – II

Design of laterally supported and unsupported beams - Built up beams, Simple beam to column connections (bolted and welded connections). Plate girders- design of section, curtailment of flange plate, bearing and intermediate stiffeners, connections, flange and web splices, Gantry girders (only design concept).

Module – III

Columns- Design of axially and eccentrically loaded compression members, simple and built up sections, lacing and battening.

Column bases- slab bases and gusseted bases.

Module – IV

Light gauge steel structures – Types of sections, Flat width ratio, Buckling of thin elements, Effective design width, Form factor, Design of tension, compression members and beams.

Plastic design- basic assumptions - shape factor, load factor- Redistribution of moments - upper bound, lower bound and uniqueness theorems- analysis of simple and continuous beams, two span continuous beams and simple frames by plastic theory - static and kinematic methods.
References:


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, drawings, etc.
20% - Regularity in the class

University Examination Pattern:

- Examination duration: 3 hours
- Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Use of IS. Codes (IS:800-2007, IS:811-1987, IS:801-1975) and Structural Steel Tables are permitted in examination halls.

Course Outcome:

The students after undergoing this course will have the
- **Capability to design structural members using relevant IS codes and steel tables.**
- **Ability to analyse the strength of structural elements.**
- **Ability to analyse statically indeterminate structures plastic moment.**
13.702 DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES (C)

Teaching Scheme: 3(L) - 0(T) - 2(D)  
Credits: 5

Course Objectives:

- To give an idea about the different type of retaining walls, water tanks, bridges, flat slabs ribbed slabs and, their components.
- Provide an understanding in analysis and design of retaining walls, water tanks, bridges and flat slabs based on relevant codal provisions.
- To give an idea to develop structural detailing of retaining walls, water tanks, bridges and flat slabs.

Module – I

Structural behaviour of different type of retaining walls. Design of retaining walls – Limit State method - cantilever and counterfort retaining walls with horizontal and inclined surcharge.

Water tanks – design of circular and rectangular water tanks at ground level and overhead, complete design excluding supporting structure – design of domes for circular water tanks.

Drawing and detailing of structures designed.

Module – II

Road Bridges – IRC specifications – Class A, Class AA loading – Design of slab bridges, T-beam and slab bridges - Design principles of Pre-stressed concrete bridges.

Flat slabs – analysis of flat slab – direct design method – principles of equivalent frame method – design of interior flat slabs for flexure and shear –Discussion on the design of exterior flat slab - Ribbed slab and the design principles.

Drawing and detailing of structures designed.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

40% - Tests (minimum 2)

40% - Class work, Drawings and Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 4 hours  Maximum Total Marks: 150*

The question paper shall consist of 2 parts.

**Part A (40 marks)** - From Module I and Module II. Two questions of 20 marks each. All questions are compulsory. There should be one question from each module.

**Part B (110 Marks)** - Candidates have to answer one full question out of the two from each module. The question consists of design and drawing part. Each question carries 55 marks (30 marks for design and 25 marks for drawing).

**Note:** Use of IS 456:2000; IS 3370 (Parts I- IV), IRC 6 & 21 and Design charts are permitted in the examination hall.

**Course Outcome:**

*The students after undergoing this course will have*

- Capability to analyse and design retaining walls, water tanks, bridges and flat slabs using relevant IS codes and SP16.
- Ability to present structural detailing of retaining walls, water tanks, bridges and flat slabs.
13.703 ADVANCED STRUCTURAL ANALYSIS (C)

Teaching Scheme: 2(L) - 2(T) - 0(P)  
Credits: 4

Course Objectives:

- To introduce matrix methods of analysis and basics of finite element analysis.
- To equip the students with a thorough understanding of the laws underlying the mechanics of structures in the mathematical framework of matrices.
- To provide a bridge between traditional methods and modern computer aided methods of analysis.

Module – I

Introduction to matrix analysis of structures – Concept of flexibility and stiffness influence coefficient - Concept of development of stiffness matrix and flexibility matrix by physical approach – Equivalent joint loads - Concept of element approach – Stiffness method by element approach - Development of compatibility matrix – Element stiffness matrices for truss, beam and plane frame elements - Development of structure stiffness matrix by element approach – Analysis of statically indeterminate beams, rigid jointed and pin-jointed plane frames by stiffness matrix approach.

Module – II

Concept of direct stiffness method – Transformation of element stiffness matrices from local to global co-ordinates – Application of direct stiffness method to two span continuous beams and pin-jointed plane frames (frames of maximum three members) - Advantages of direct stiffness method.


Module – III

Analysis of statically indeterminate beams, rigid jointed and pin-jointed plane frames by flexibility matrix approach. Comparison of flexibility matrix and stiffness matrix methods.

Module – IV

Introduction to finite element analysis – Concept of discretization of continuum - Finite element analysis procedure – Relevant basics of elasticity – Stress-strain relation (Constitutive relation) - Strain-displacement relation – Concept of strain-displacement matrix – Types of 1-D, 2-D and 3-D finite elements –

References


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours          Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

After successful completion of the course, the students will be able to:

- Understand what happens behind the black box of the software package commonly used for structural analysis
- Check the results generated by the computer output
- Face the analysis of challenging structural systems confidently.
13.704.1 STRUCTURAL ANALYSIS FOR DYNAMIC LOADS (C) (Elective I)

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

Course Objective:

- To understand the behaviour of structures under dynamic loads
- To provide understanding of basic dynamic analysis procedures and seismic force calculations.

Module – I


Module – II

SDOF systems subjected to support motion. Vibration isolation – Transmissibility.

Response to impulsive loading – half sine, rectangular and triangular impulses. Impulse response function, Response of SDOF systems subjected to general dynamic loading – Duhamel integral.

Module – III

Multi-degree of freedom (MDOF) systems, Modelling - Lumped mass and consistent mass, Shear building frames, Equation of motion of MDOF systems, Natural frequencies and mode shapes, Orthogonality of normal modes, Forced vibration analysis - Mode superposition method.

Module – IV

Distributed parameter systems, Differential equation – beam flexure (elementary case), Natural frequencies and mode shapes of simply supported beams.

Introduction to earthquake analysis – response spectrum, Response spectrum analysis of MDOF system subjected to support motion.

Calculation of design seismic forces in building frames using IS:1893-2002 (Equivalent lateral force method only).

References:


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

- Examination duration: 3 hours
- Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Use of IS 1893 :2002 is allowed in the examination.

**Course Outcome:**

After successful completion of the course, the students will have awareness of the dynamic response of structures. They will be able to apply engineering knowledge to model dynamic systems and obtain their response due to dynamic loads.
13.704.2 ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES (C)
(Elective I)

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

Course Objective:
To give an in-depth idea regarding the advanced theoretical knowledge of reinforced concrete structure giving importance to those areas which are not covered in the basic RCC design of structures subject.

Module – I

Module – II
Behaviour and design of reinforced concrete members in flexure, flexural shear- Analysis and design of compression member – slender columns, including biaxial bending. Serviceability limit states- estimation of deflection, immediate and long term deflection, control of cracking, estimation of crack width in RC members –codal procedures on crack width computations.

Module – III
Design of special RC members-Analysis of shear walls- distribution of lateral loads in uncoupled shear walls, Design of concrete corbels.

Module – IV
Design of ribbed slabs, deep beams, pile caps. Yield line analysis of slab, yield line mechanisms- equilibrium and virtual work method.

References:
1. Hong F.K. & Evans R.H., Reinforced and Pre-stressed concrete, Taylor and Francis
2. Clien W. F., Plasticity on Reinforced concrete
5. Ramakrishna and Arthur, Ultimate Strength Design for Structural Concrete.

**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Use of IS 456 :2000 and SP: 16 Charts are allowed in the examination.

**Course Outcome:**

The students after taking this course will be able to analyse the complicated behaviour of concrete structures and will be able to design special RCC structures.
13.704.3 EARTH DAM ENGINEERING (C) (Elective I)

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

Course Objective:
To impart to the students the fundamentals of Earth and Rock fill dams; To enable students to acquire proper knowledge regarding the design and analysis aspects of earth and rock fill dam Engineering.

Module – I

Module – II

Module – III

Module – IV
Rockfill dams- General characteristics – Impervious membrane and earth cores – Control of rock fill placement – Settlement of rockfill.

References:

Internal Continuous Assessment (Maximum Marks-50)
50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the course the student understands the basic principles governing the design of earth and Rock fill dams and also they acquires the ability to understand the applicability and limitations of various design methods.
13.704.4 SOIL EXPLORATION (C) (Elective I)

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

Credits: 4

Course Objective:
- To impart to the students, a clear idea about how a geotechnical investigation programme is to be planned and executed.
- To impart in-depth knowledge about the various methods of geotechnical investigation and the field tests to be conducted in different situations.

Module – I


Module – II


Module – III

Geophysical methods – Seismic refraction method – Procedure, uses, limitations – Solution of numerical problems to estimate the velocity of seismic waves and the thickness of upper layer of a two-layered soil system - Electrical resistivity method – Electrical profiling and electrical sounding – Procedure, uses, limitations . Cyclic pile load test –Procedure for separation of end bearing and skin friction resistance- solution of numerical problems using cyclic pile load test data - Determination of field permeability by pumping out test [no derivation required].

Module – IV

Soil sampling – Undisturbed, disturbed, and representative samples – Chunk and tube samples – Factors affecting sample disturbance and methods to minimise them – Significance of Area ratio, Inside clearance, Outside clearance and Recovery ratio –

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

After successful completion of the course, the students understand the procedure, applicability and limitations of various methods of geotechnical investigation; Ability of the students in making proper engineering judgements and in taking appropriate decisions related to geotechnical investigations is greatly improved.
13.704.5 GEOINFORMATICS (C) (Elective I)

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

Course Objective:

- To impart a basic knowledge on geospatial data and its importance in infrastructure development and resource management.
- To familiarize the different geospatial data acquisition systems like GPS, remote sensing and geospatial data analysis platforms like GIS.

Module – I


Module – II

GPS Basics- system overview-working principle of GPS-Satellite ranging-calculating position-Ranging errors and its correction-code phase and carrier phase measurements - GPS Surveying methods-Static, Rapid static , Kinematic methods - Real time and post processing DGPS- GPS Survey planning and observation-horizontal and vertical control - GPS data processing- Applications of GPS.

Module – III


Module – IV


References:


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

- Examination duration: 3 hours
- Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

After successful completion of the course, the students will be benefited by the knowledge of recent geo information technologies.
Course Objective:

- Apply conservation of mass, momentum and energy principles to open channel flow problems
- Design channels using the concepts of uniform flow and gradually varied flow conditions
- Introduce the principles of unsteady one-dimensional flows in open channel problems
- The course is designed to give the engineering student a solid understanding of open channel hydraulics, particularly in steady, gradually varied flow, spatially varied flow and a basis for the design of free surface systems.

Module – I

Open channel flow: Velocity and pressure distribution-energy and momentum correction factors-Pressure distribution in curvilinear flows. Energy and momentum principle-critical flow, Application of specific energy principle to channel transitions with hump or change in width, specific force, Uniform flow- composite sections, Hydraulic exponents N and M-computation of uniform flow.

Module – II

Design of channels for uniform flow, Non-erodible channels – minimum permissible velocity, best hydraulic section, Erodible channels with scour but do not silt-tractive force and permissible velocity approach- stable hydraulic section.

Module – III

Varied Flow: Dynamic equations of gradually varied flow, assumptions and characteristics of flow profiles, classification of flow profile, draw down and back water curves, profile determination, graphical integration, direct step and standard step method, numerical methods, flow through transitions.

Module – IV

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

After successful completion of the course, the students will be capable of understanding the basic principles of open channel hydraulics and applying them in solving practical flow problems relating to open channel flows.
13.704.7 AIR QUALITY MANAGEMENT (C) (Elective I)

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

Course Objective:
- To understand the basic principles of air quality management
- To understand various engineering concepts involved in control and regulation of air pollution.

Module – I


Air quality standards and legislation: - Ambient air quality standards, air quality emission standards, air pollution control legislation.

Module – II


Module – III

Air sampling and analysis of air pollutants: Principles and instruments for pollution control; Ambient air quality & emission standards, Indoor pollution, Sampling train for ambient air sampling and stack sampling, particulate and gas analysis.

Module – IV

Control of air pollutants: Particulate emission control, Gaseous emission control, Biological air pollution control techniques, Bio-scrubbers, Removal of gaseous pollutants. Different methods, Adsorption, Absorption, Condensation, Incineration, Automobile pollutants, control of automobile emissions.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of the course, the students will be able to understand the significance, need and methods of air quality management programs.*
13.704.8 HIGHWAY AND AIRFIELD PAVEMENT MATERIALS (C) (Elective I)

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

Course Objective:
- To understand the characteristics and tests of flexible and rigid pavements materials.
- To study recent developments in construction practices and modern equipments used.

Module – I


Module – II


Module – III

Material characterization for Cement concrete pavements- Properties and tests for the materials used for CC pavements. Construction of Cement concrete pavements – Preparation of Subgrade and Base, Presetting reinforcements in joints and PCC slab construction stages. Thin white topping and ultra thin white toppings.

Module – IV


References:
4. IRC SP: 63-2004, Guidelines for Use of Interlocking Concrete Block Pavement, Indian Roads Congress.


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

- **Part A (20 marks)** - Five short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

- **Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of the course, the students will understand the need for tests and procedures adopted for construction. To equip the students with practical sense of road construction using suitable materials*
13.704.9 SUSTAINABLE DEVELOPMENT (C) (Elective I)

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

Course Objective:
- To understand and familiarise with the concept of Sustainable Development.
- To learn about sustainable building materials and construction.
- To learn about energy efficient material and construction.
- To learn about waste reduction in construction industry.

Module – I
Concepts of sustainability: Energy and Global environment, Energy use and Climate change – Its impact, Types of Energy systems, Concept of Sustainability - Principles of conservation - synergy with nature, Bioregionalism - community basis shelter technology within bioregional patterns and scales, Ethical- environmental degradation.

Module – II
Sustainable Building Materials: Properties, Uses and Examples of - Primary, secondary and Tertiary Sustainable Materials. Principles to improve the energy efficiency - siting and vernacular design, shade, ventilation, earth, shelter, thermal inertia and air lock entrances; solar water heating panels; photovoltaic electricity generation.

Module – III
Techniques of sustainable construction - technologies, methods of effectiveness, and design synthesis – Green buildings - alternative materials and construction methods: use of local materials and on site growth of food, fuel and building materials.

Module – IV

References:
2. Laurie Baker, Chamoli Earthquake Hand Book, Costford (Centre of Science and Technology for Rural Development), 2000.


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

- **Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

- **Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of the course, the students will be able to:*

- comprehend sustainable development concept in civil engineering practices.
- choose materials and evolve construction procedures to suit sustainable development.
- choose energy efficient materials and construction techniques.
- adopt and suggest waste reduction methods in construction industry.
13.704.10 COASTAL ENGINEERING (C) (Elective I)

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

Course Objective:  
To provide knowledge on the mechanics of ocean waves and its applications in Coastal Engineering.

Module – I

Introduction, Impact on Coastal Environment due to human activities- Integrated Coastal Zone Management (ICZM) and its importance in India, Ocean Waves and their generation-Classification of waves- Wave theories-Linear wave theory- wave length and Celerity-Water particle velocity- Water particle acceleration-Water particle displacement- Pressure with in a Progressive wave-Wave Energy.

Module – II


Module – III

Coastal zone process-beach profiles- Near shore and long shore sediment transportation-(descriptions only – no computation) Littoral drift- Wave forces on structures- Wave forces on Vertical walls due to non-breaking waves, breaking waves and broken waves – Problems- Forces on circular cylinders- Morison equation-Froude-Krylov Force.

Module – IV

Harbour Oscillations- Free oscillations in two and three dimensional basins- forced oscillations Shore protection works-Various types of Break waters, Seawalls, Groynes- Armour units - Hudson’s formula- Simple design of Rubble mound breakwater. Beach nourishment and sand bypassing.

References:

**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of the course, the students will be able to analyse and design coastal structures like breakwaters, seawalls, harbour etc.*
13.704.11 ENVIRONMENTAL SCIENCE AND MANAGEMENT (C) (Elective I)

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

Course Objective:
To give an awareness in the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participate.

Module – I


Module – II


Environment and Sustainable development- definition- Principles- Objectives- Importance- Sustainable use of natural resources- threats to biodiversity- Habitat loss- Poaching of wildlife, man, wild life conflicts- Endangered and endemic species of India.

Module – III


Module – IV


Applications of modern technologies-Remote sensing and GIS in environment management.

References:
2. Bharucha Erach, Biodiversity of India, Mapin Publishing, Ahmedabad, India.

**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

After successful completion of the course, the students will be able to propose any project, or any development activity only after giving due consideration to conserve our natural resources and minimum environmental degradation.
13.704.12 MODERN CONSTRUCTION MATERIALS (C) (Elective I)

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

Course Objective:
- To introduce the conventional materials and their modern use
- To expose the students to recent developments in construction materials.

Module – I


Module – II


Module – III


Module – IV


References:

4) Don A Watson, *Construction Materials and Processes*, Career Education
**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours  
Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

After successful completion of the course, the students will be able to

1. Describe the various materials used for construction of structures.

2. Decide the material most suited and economical for the construction of a structural element.

3. Combine durability and sustainability in material selection.
13.705.1 PRE-STRESSED CONCRETE (C) (Elective II)

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

Course Objective:

To impart to students the knowledge of methods of prestressing, analysis and design of various prestressed concrete elements under relevant codal provisions.

Module – I

Basic concepts and brief history of prestressing, advantages and limitations of prestressing, types of prestressing, prestressing systems and devices, concrete and steel used in prestressed concrete, losses in prestress.

Module – II

Analysis of members under flexure, shear and torsion. Design of flexural members – Type I and Type II sections, design of end block, design for shear and torsion, detailing of reinforcement.

Module – III

Design of one way and two way slabs, Analysis and design of continuous beams. Partial prestressing (concept only).

Module – IV

Composite construction: Concept, types and analysis only. Circular prestressing: Analysis and design of pipes and water tanks.

References:

3) Rajagopalan N., Prestressed Concrete, Alpha Science, 2002.
Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours \hspace{1cm} Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.


Course Outcome:

After successful completion of the course, the students will be able to understand and use suitably the different concepts of prestressing and the design of various prestressed concrete members used in practice.
Course Objective:

Composite materials are finding immense application in the field of aerospace, automobile and Civil engineering presently due to its outstanding material capability. It is required for the present structural engineers to know the fundamentals of composite material for designing composite structures in various fields.

Module – I

Introduction. Composite Fundamentals: Definition of composites, Objectives, constituents and Classification of composites; structure (multilayered and multiphase); General Characteristics of reinforcement- classification, terminology used in fibre science, Polymer matrix composites- Thermoplastics and thermosetting resins; mechanical properties, glass transition temperature. Structural applications of Composite Materials.

Module – II

Macro mechanical behaviour of composite lamina - Review of Basic Equations of Mechanics and Materials and Linear Elasticity in 3D and 2-D plane stress and plane strain - Number of elastic constants and reduction from 81 to 2 for different materials. Stress-Strain Relations for a unidirectional and orthotropic lamina. Effective Moduli of a continuous fibre - reinforced lamina.

Module – III


Module – IV

Macro mechanical behaviour of a laminate- Classical Lamination Theory, stress-strain variation, In-plane forces, bending and twisting moments, Effects of stacking sequence-coupling effects, special cases of laminate stiffness. Laminate strength analysis procedure-Failure envelopes, Progressive failure Analysis. Free-Edge inter-laminar Effects.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of the course, the students will have:*

- An ability to identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.

- A basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior.

- An ability to predict the failure strength of a laminated composite plate.

- An ability to use the ideas developed in the analysis of composites.
13.705.3 GROUND IMPROVEMENT (C) (Elective II)

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

Course Objective:

- To introduce the various types of improvement methods of engineering properties soils.
- To introduce the application of engineering methods to ground improvement projects
- To demonstrate how theoretical knowledge and observation of engineering performance assist in rational application of ground modification procedure.

Module – I

Role of ground improvement- Drainage and Ground water lowering- Well point systems- Electro osmotic methods- Thermal and Freezing methods..

Module – II

In situ densification- Deep compaction- Dynamic Compaction- Blasting-Sand piles- Preloading with sand drains-Stone columns- Lime piles.

Module – III

Earth Reinforcement- Rock bolts- Cables and guniting- Geotextiles as reinforcement- Filtration, Drainage and Erosion Control-Soil Nailing-Micropiles.

Module – IV

Grouting- Types- Rheology- Applications- Electrochemical Stabilization- Physical and Chemical aspects of stabilization- Stabilization with cement lime etc.

References:


Internal Continuous Assessment *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
University Examination Pattern:

Examination duration: 3 hours  
Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

A study of the many different approaches to the ground modification broadens the mind of any Engineer and inspires creativity and innovation in Geotechnical Construction and related fields; Equips to make an informed decision on the tools for the selection and the design of main interventions for the improvement for particular situation.
13.705.4 GEO-ENVIRONMENTAL ENGINEERING (C) (Elective II)

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

Course Objective:
To impart to the students, the impact of pollution on soil properties, need for landfill and design concepts of land fill.

Module – I
Waste Generation – source, type, quantity, characteristics and management of waste; Geotechnical properties of solid waste - density, particle size, temperature, pH, moisture content, compressibility, permeability, shear parameters; geotechnical reuse of waste materials.

Module – II
Waste dump - changes occurring in waste dump, its impact on environment, remedial measures for waste dump, engineered landfill – types, selection and ranking of landfill sites based on sensitivity index – landfill planning-components of landfill – landfill capacity.

Module – III
Liner and cover system - compacted clay liner, geomembrane liners, geosynthetic clay liner, required properties of liners - insitu permeability measurement of clay liners, Leachate quality and quantity collection pipes, materials for drainage layer; leachate recirculation and Treatment; Gas management and collection facilities.

Module – IV
Soil waste interaction; contaminant transport - advective, diffusive, dispersive and combined process - attenuation capacity- change in engineering properties; permeability, shear strength, Atterbergs limit, compressibility and swell. Soil remediation- soil washing, fixation, electrokinetic remediation, biological treatment, thermal treatment and containment.

References:

**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours  
Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

After successful completion of the course, the students will be able to understand the basic principles of the design of landfill.
13.705.5 GROUND WATER ENGINEERING (C) (Elective II)

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

Course Objective:
- To provide students a quantitative understanding of the hydraulics of subsurface fluid flow and its engineering applications.
- To provide understanding about characteristics of porous media, Darcy’s law of fluid flow in porous media, ground water investigation methods etc.

Module – I

Vertical distribution of ground water. Types of geologic formations - properties of aquifer related to storage and transmissivity of water. Steady unidirectional flow - steady flow in a homogeneous aquifer - aquifer with recharge - Flow into infiltration galleries – problems from steady unidirectional flow. Steady radial flow towards wells – Discharge through confined and unconfined aquifers - Problems from steady radial flow towards wells.

Module – II


Module – III


Module – IV


References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

After successful completion of the course, the students will be able to:

- Understand the occurrence and movement of groundwater through porous media.
- Apply Darcy’s Law to simple groundwater flow problems.
- Design and conduct experiments, as well as to analyze and interpret data.
13.705.6 SOLID WASTE MANAGEMENT (C) (Elective II)

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

Course Objective:

- To introduce the solid waste engineering principles and management issues.
- To understand the legislation of solid waste management, treatment technologies and current issues.

Module – I

Definition-Sources- Categories of Wastes- Generation rate- Measure of quantities, methods used to generation rate, Physical and chemical composition (simple problems)- Storage of solid waste at source- Container storage location.

Module – II


Module – III

Disposal of solid waste; Sanitary landfill-area method, trench method- Landfill classifications, types and methods- Landfill siting considerations- advantages and disadvantages. Incineration-types of incinerators- parts of an incinerator- advantages and disadvantages. Composting-types of composting-Indore process, Bangalore process, advantages and disadvantages.

Module – IV


References:

4. David A. Cornwell and Mackenzie L. Davis, Introduction to Environmental

**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of the course, the students will be able to develop appropriate solid waste management strategies to meet local needs.*
13.705.7 TRANSPORTATION PLANNING (C) (Elective II)

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

Course Objective:

- To introduce the role of planning in analysing and modelling travel demand.
- To understand the stages involved in the Urban Transportation Planning process.
- To study the principle of land use transport interaction models, it’s mathematical formulation and solution.

Module – I

Systems approach to urban transportation planning concepts; flow chart for transportation Travel demand concepts, Data needs for planning process, Use of secondary data. Definition of the study area. Cordon line, screen line, Zoning, sample size determination, Data collection techniques. O-D surveys.

Module – II


Module – III

Modal split analysis, Modelling travel behaviour. Aggregate and Dis-aggregate Models, Probabilistic models- probit and logit models. Trip assignment models. Minimum path assignment. All or nothing assignment, Equilibrium assignment, Capacity restrained assignment, Multiple path assignment. Diversion curves.

Module – IV

Landuse-transport models. Lowry model. Lowry Garin model. Iterative solutions. Introduction to some transportation planning softwares.

References:

1) Bruton M. J., Introduction to Transportation Planning, Hutchinson, London.
5) Partha Chakroborty, Principles of Transportation Engineering, Prentice-Hall.


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

- **Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

- **Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of the course, the students will be able to:*

- Understand the various transportation planning concepts
- Understand four step modelling concept in Urban Transportation Planning.
- Familiarise the mathematical travel demand model development, concepts and its solutions.
13.705.8 ADVANCED COMPUTATIONAL METHODS (C) (Elective II)

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

Course Objective:
- To provide an insight to the numerous numerical techniques available for the simulation and solution of many physical problems in the Civil Engineering field.
- To give exposure to programming in numerical methods, which may help them during higher studies.

Module – I


Module – II

Data smoothing by least squares criterion – parabolic and non-polynomial models like exponential model and power equation – Multiple linear regression method.

Lagrangean and Hermitian interpolation – Quadratic splines - cubic splines (Examples with equal intervals only).

Module – III


Higher order equations of initial value type by Runge-Kutta method.

Ordinary differential equations of the boundary value type – Finite difference solution.

Module – IV


Elliptic equations – Finite difference method — Problems with irregular boundaries.


Note: Importance must be given to structural engineering problems wherever possible. Assignments must be computer oriented.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

The students after undergoing this course will be able to

- demonstrate various methods available for scientific computations.
- obtain numerical solutions of ordinary and partial differential equations.
- apply appropriate numerical techniques for the solution of civil engineering problems.
13.705.9 OPTIMIZATION TECHNIQUES IN ENGINEERING (C) (Elective II)

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

Course Objective:

- To develop the ability to formulate the real field engineering problems in an optimization framework.
- To develop the ability to use optimization techniques for real life applications.

Module – I

Optimization - steps in optimization problem solving, basic terminologies, concavity and convexity of mathematical functions, types of optimization problems.

Formulation of different types of optimization problems-minimum weight design of beams, columns, trusses and frames, water quality modeling, minimum cost design of irrigation canals.

Module – II

Solution of optimization problems- Single variable unconstrained optimization techniques-one dimensional minimization. Elimination methods-Interval halving, Fibonacci search and Golden section methods.


Module – III

Gradient based methods- steepest descent method, Fletcher Reeves method, Newton method, Quasi Newton method- BFGS method.

Conceptual ideas of (No problems) Reliability based optimization, Constraint handling-Penalty function approach, Multi-objective optimization, dynamic programming and Bellman’s principle of optimality etc.

Module – IV

Linear programming (LP)-two phase solution of Simplex method, Duality of LP problems, Integer programming- Gomory’s cutting plane method. Geometric programming- minimum weight design of trusses.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc. At least one assignment should be computer oriented. One assignment can be to create general awareness of search based algorithms for engineering problem solving.

20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours  
Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Questions with more than two variables should not be asked from Module II and Module III

**Course Outcome:**

After successful completion of the course, the students will be able to:

- Describe the basic concepts of optimization
- Formulate the optimization models for real field engineering problems
- Select and apply appropriate method for solving real life problems.
13.705.10 DESIGN OF OFFSHORE STRUCTURES (C) (Elective II)

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

Course Objective:
- To impart basic knowledge in civil engineering aspects of offshore structures.
- To familiarize the students in the areas of design aspects of offshore structures.

Module – I

Loads on Offshore Structures: Wind Loads; Wave and Current Loads; Calculation based on Maximum base Shear and Overturning Moments; Design Wave heights and Spectral Definition; Hydrodynamic Coefficients and Marine growth; Fatigue Load Definition and Joint Probability distribution; Seismic Loads.

Different types of ocean structures and systems - Gravity, fixed, floating semi submersibles, compliant structure-Tension legged platform and guyed tower.

Module – II

Design of fixed offshore Jacket Platform-Steps in design. Environmental load calculation (wind, wave, current and tidal) and design parameters. Problems on checking the sufficiency of tubular members under different loading conditions in conformity with the API-Code. Tubular Joints-different types. Analysis of Joints, Stress concentration factor, fatigue failure-SN curves.

Module – III

Basic principles of design of concrete offshore platforms - Jack up platforms, Wave forces on large structures-Froude-Krylov Forces-General theory. Design of compliant structures forces & bending moments in floating platforms Design principles of - Tension leg platform Sizing and mechanics –weight estimate of TLP.

Module – IV


References:
1. Thomas H. Dawson, Offshore structural Engineering.

**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.
- 20% - Regularity in the class

**University Examination Pattern:**

- Examination duration: 3 hours  
  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** No charts, tables, codes are permitted in the Examination hall. If necessary the same shall be given along with the question paper by the question paper setter.

**Course Outcome:**

After successful completion of the course, the students will be able to:

- Understand the effects of various forces acting on offshore structures.
- Plan and design offshore structures.
13.705.11 TRANSPORTATION SYSTEM MANAGEMENT (C) (Elective II)

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

Course Objective:

- To gain an understanding of the basic principles of planning transport systems.
- To provide an understanding of the principles of urban transport and the requirements of an efficient transport system.

Module – I


Traffic Operations Improvement: On-street parking ban, one-way streets, reversible lanes, traffic calming, Right turn phase, right turn lanes, reroute turning traffic, Auto Restricted Zones-Traffic Diverters.

Module – II

Study of TSM actions with respect to problems addressed, conditions for applications, potential implementation problems, evaluation & impact analysis- park and ride, Ridesharing, exclusive lanes, priority at ramp terminals, bus transfer stations, limited and skip-stop bus services, Public transportation & HOV treatment.

Module – III

Demand Management: Staggered work hours, flexible work hours, high peak period tolls, shuttle services, circulation services, extended routes.


Module – IV

Parking Management: Benefits of good parking management, curb parking, off street parking, Parking supply and demand, Parking and Terminal Facilities.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** No charts, tables, codes are permitted in the Examination hall. If necessary relevant data shall be given along with the question paper by the question paper setter.

**Course Outcome:**

After successful completion of this course, the students will be able to apply an array of planning management techniques for improving transport efficiency in a city and solving problems such as congestion to demonstrate various methods available for scientific computations.
13.706 ENVIRONMENTAL ENGINEERING LAB (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:
- To get an idea of sampling and preservation of water samples.
- To make an awareness on the importance of drinking water standards and its specified limits.
- To get the practical experience in analysis of water samples.

Pre requisites: 13.502 Environmental Engineering I (C)

List of Experiments:
Analysis of water for any eight of the following:
1. pH, Turbidity
2. Hardness
3. Acidity
4. Alkalinity
5. Residual Chlorine
6. Chlorides
7. Dissolved Oxygen
8. Total Solids
9. a) Sulphates  
   b) Sulphides
10. Iron
11. Jar Test

Internal Continuous Assessment (Maximum Marks-50)
- 40% - Test
- 40% - Class work and Record
- 20% - Regularity in the class

University Examination Pattern:
- Examination duration: 3 hours  
  Maximum Total Marks: 100
- Questions based on the list of experiments prescribed.
- 80% - Theory, Procedure and tabular column (30%);
Conducting experiment, Observation, Tabulation with Sample calculation (30%)  
Graphs, Results and inference (20%)  

20% - Viva voce  

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After successful completion of the course, the students will be able to

- Characterize the water sample  
- Identify the importance of drinking water standards and their permissible limits.
13.707 GEOTECHNICAL ENGINEERING LAB (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)  
Credits: 2

Course Objective:

- To achieve practical experience in testing of soils.
- To get familiar with standard quality laboratory testing procedures for determining the basic properties and engineering behavior of soil.

Pre requisites: 13.504 Geotechnical Engineering I (C)

List of Experiments:

1. Determination of Specific Gravity  
   - Pycnometer Method
2. Determination of Field Density and Void Ratio  
   - Sand Replacement Method
   - Core Cutter Method
3. Particle Size Determination  
   - Sieve Analysis
   - Hydrometer Analysis
4. Consistency (Atterberg) Limits Determination  
   - Liquid Limit Test
   - Plastic Limit Test
   - Shrinkage Limit Test
5. Permeability Determination  
   - Constant Head Permeameter Test
   - Variable Head Permeameter Test
6. Shear Strength Determination  
   - Unconfined Compression Test
   - Direct Shear Test
   - Triaxial Compression (UU) Test (Demonstration only)
7. Consolidation Test
8. Compaction Test  
   - Standard Proctor Compaction Test

Note: The relevant IS Codes on methods of testing should be adopted for the above tests.

Reference:

**Internal Continuous Assessment** *(Maximum Marks-50)*

- 40% - Test
- 40% - Class work and Record
- 20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

Questions based on the list of experiments prescribed.

- 80% - Theory, Procedure and tabular column (30%);
  - Conducting experiment, Observation, Tabulation with Sample calculation (30%)
  - Graphs, Results and inference (20%)

- 20% - Viva voce

*Candidate shall submit the certified fair record for endorsement by the external examiner.*

**Course Outcome:**

*After successful completion of the course, the students will be able to*

- Determine the basic and engineering properties of soils relevant to field application
- Analyse and document the results.
13. 708 SEMINAR, SURVEY CAMP & INDUSTRIAL VISITS (C)

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

**Course Objective:**
- *The seminar provides students adequate exposure to public presentations to improve their communication skills.*
- *Industrial visits expose the students to real-life industrial situations and research activities.*
- *Survey camp helps the students to improve their ability to perform as an individual as well as a team member in completing a project work.*

**(a) SEMINAR**

Each student is required to present a seminar on a topic of current relevance in Civil Engineering and other related areas of current importance. They are expected to refer research and review papers from standard journals like ASCE, IEI, ELSEVIER, etc. Each student shall give a power point presentation of 15 minutes duration on his/her seminar topic in an audience of students and staff members from the department.

Students from lower semesters may also attend the seminar presentation. The seminar presentation shall be assessed by a panel consisting of the Head of the Department, seminar coordinator, and 2/3 faculty members. The Head of the Department shall be the chairman of the panel.

Each student should also prepare a well-documented report on the seminar topic as per the format and submit to the department at the time of his/her seminar presentation. While preparing the report, at least three cross references must be used. The seminar report must not be the reproduction of the original report.

**(b) (i) SURVEY CAMP &**

Survey Camp should be completed before the commencement of 7th semester. The minimum duration of the survey camp should be one week. The use of total station and GPS is compulsory for survey work.

**(ii) INDUSTRIAL VISITS**

Students have to visit at least three industries/research institutes relevant to civil engineering as part of industrial training to understand the processes/activities.

A report of the same should be submitted at the end of 7th semester and evaluation should be based on this report. A certified report on industrial visits should be available with the student for Project and Viva voce at the end of Eighth semester.
Internal Continuous Assessment *(Maximum Marks-150)*

40% - Seminar  
30% - Survey Camp and report  
30% - Industrial Visits and report

Course Outcome:

*This course shall provide students better communication skills, exposure to working of industries and improve their leadership quality as well as the ability to work in groups, and thus aid them in building a successful career as a civil engineer*