UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

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

#### VII 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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<th>Total Marks</th>
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<td>Design of Offshore Structures (C)</td>
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**ELECTIVE -II**
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-Analysys 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.
**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.
13.704.6  FREE SURFACE FLOW (C) (Elective I)

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

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:


**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 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.
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:

1) Michel S. Mamlouk and John P. Zaniewski, Materials for Civil and Construction Engineers, Prentice Hall.
4) Don A Watson, Construction Materials and Processes, Career Education
5) F. Young, S. Mindess, R. J. Gray and A. Bentur, The Science and Technology of Civil Engineering Materials, Prentice Hall
6) Gandhi M. V. and B. S. Thompson, Smart Materials and Structures, Chapmann & Hall, London
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  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.
13.705.2 MECHANICS OF COMPOSITE MATERIALS (C) (Elective II)

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

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.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours \hspace{5em} 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 landfill.

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
Engineering, McGraw Hill.

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:**


**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.
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*