UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

SYLLABUS FOR
VIII 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>
<th>Exam Duration</th>
<th>UE Max Marks</th>
<th>Total Marks</th>
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<tbody>
<tr>
<td>13.801</td>
<td>Quantity Surveying and Valuation (C)</td>
<td>4</td>
<td>L 3 T 1 D/P -</td>
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<td>3</td>
<td>100</td>
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<tr>
<td>13.802</td>
<td>Design and Drawing of Steel Structures (C)</td>
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<td>13.803</td>
<td>Urban Planning and Architecture (C)</td>
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<td>L 4 T - D/P -</td>
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<td>L 3 T - D/P -</td>
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<td>13.805</td>
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**ELECTIVE -III**

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<tr>
<th>Course No</th>
<th>Name of subject</th>
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<tr>
<td>13.805.1</td>
<td>Earthquake Resistant Design of Structures (C)</td>
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<tr>
<td>13.805.2</td>
<td>Wind Loading on Structures (C)</td>
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<td>13.805.3</td>
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<td>13.805.7</td>
<td>Design and Construction of pavements (C)</td>
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<td>13.805.8</td>
<td>Repair &amp; Rehabilitation of Structures (C)</td>
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**ELECTIVE -IV**

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<tr>
<td>13.806.1</td>
<td>Finite Element Methods (C)</td>
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<td>13.806.2</td>
<td>Design of Bridges (C)</td>
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<td>13.806.3</td>
<td>Reinforced Earth (C)</td>
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<td>13.806.4</td>
<td>Advanced Foundation Engineering (C)</td>
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<td>13.806.5</td>
<td>Irrigation and Drainage Engineering (C)</td>
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<td>13.806.6</td>
<td>Industrial Waste Water Management (C)</td>
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<td>13.806.7</td>
<td>Traffic Engineering (C)</td>
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<td>13.806.8</td>
<td>Valuation of Real Properties (C)</td>
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<tr>
<td>13.806.9</td>
<td>Design of Port, Harbour and Coastal Structures (C)</td>
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</table>
13.801 QUANTITY SURVEYING AND VALUATION (C)

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

Course Objectives:

- To get concepts and ideas in quantity surveying with respect to the estimation of any construction and to understand the basis of valuation of any building or construction.
- To develop skill in preparing detailed estimate using Data book and Schedule of rates.

Module – I


Module – II

Quantity Surveying- Basic principles-Types of Estimate- Detailed estimate including quantities, abstract and schedule of rates of various items of works- residential buildings, office/ school building, Sanitary and water supply works- Soak pits, Septic tanks, Culverts, Retaining walls.

Module – III

Bar-bending schedule-preparation of bar-bending schedule for RCC works connected with building construction (beam, slabs, columns, footing), Culverts, Retaining walls and minor irrigation works.

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, 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 from Module I and Module IV carries 15 marks. Each question from Module II and Module III carries 25 marks.

**Note:** For analysis of rate and cost estimation, unit rate and labour requirement should be given along with the questions by the question paper setter. No other 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 after undergoing this course will have the capability to prepare detailed estimate of various construction works and to present valuation report of buildings.
13.802 DESIGN AND DRAWING OF STEEL STRUCTURES (C)

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

Course Objectives:

- To introduce the various design philosophies applicable to some special structures.
- To apply the knowledge structural analysis and design in the design of complete structure.
- To communicate the design details by preparing drawings.

Module – I

Water tanks- Design of rectangular steel tanks- Pressed steel tanks- Cylindrical tanks with hemispherical bottom- Design of supporting towers and its foundation.

Roofs -Design of purlins and trusses for dead load, live load and wind loads - rolled steel angle and tubular sections.

Drawings of the structures designed above.

Module – II

Steel chimneys-Types of chimneys, IS Specifications-Design of self supporting chimneys.

Steel bridges –Types of bridges, Railway modified BG and modified MG loading -Design of plate girder bridges - Truss girder bridges (only design concept) -bracings and bearings.

Drawings of the structures designed above.

References:

7. Railway Loading Standards (Bridge Rules), Ministry of Railways, Govt. of India, 2008.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, preparation of structural drawings

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. Codes 800-2007, 875 (2&3)-1987, 6533-1989 and Railway loading standards are permitted in the examination hall.

Course Outcome:

The students after undergoing this course will have

• Capability to design complete structure after performing required analysis for intended loading.

• Ability to prepare detailing drawing required for the trouble-free execution of the structures.
13.803 URBAN PLANNING AND ARCHITECTURE (C)

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

Course Objectives:

- To develop awareness of creative principles and styles of architecture.
- To develop a basic knowledge in urban development and planning.
- To develop awareness of the sustainability dimensions of architecture and urban development.

Module – I


Module – II


Module – III


Module – IV

Introduction to the concept and issues of Sustainable Architecture – basic concepts of Green Buildings – energy efficiency in buildings( brief description only ) – resource conservation and sustainable construction – various rating systems for the assessment of sustainability - Indian systems TERI GRIHA, LEED India rating – Sustainable building practices in India.
References

10. Ramachandran R., *Urbanization and Urban System in India*
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 identify creative principles and styles of architecture.
- possess a basic knowledge in urban development and planning
- be able to comprehend architecture and urban development from sustainability perspective.
13.804 CONSTRUCTION MANAGEMENT (C)

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

Course Objectives:

- To make a student aware of the evolution of management thought.
- To follow the life cycle of a civil engineering project, from its conception to completion.
- To make a student aware of the state-of-the-art computer tools in management.
- To give an overview of construction economics, which will help a student to assess the financial feasibility of projects and aid in decision making.
- To make a student aware of the governmental system of project execution, starting from floating a tender to contract conditions.
- To provide a deeper understanding of scheduling techniques.

Module – I


Module – II

Construction project management – types of construction projects - different phases in the life cycle of a construction project. Construction economics - time value of money - techno-economic feasibility study - cost benefit analysis - rate of return analysis. Computer capabilities in management.

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, 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 be able to:

- Describe construction management concepts in the backdrop of construction industry.
- Explain the life cycle of a construction project.
• Relate to the popular computer tools used in project management.
• Prepare tender and contract documents of civil engineering works based on prevailing rules and regulations.
• Formulate construction schedules.
• Apply efficient strategies for resource management.
13.805.1 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES (C) (Elective III)

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

Course Objective:

- To learn the basics of analysis of structures subjected to earthquake load
- To provide an understanding of fundamental knowledge of earthquake resistant design of structures.

Module – I


Module – II


Module – III


Module – IV

RC structures - Effect of confinement of concrete Ductility considerations in earthquake resistant design of RC buildings – Discussion of relevant clauses in IS 13920 for earthquake resistant design of RC beams, columns and shear walls. Basics of capacity based design Masonry buildings - Earthquake resistant construction practices.

References:

3. IS 13920 : 1993, Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces - Code of Practice.
5. Agrawal P. and M. Shrinkande, Earthquake Resistant Design of Structures, PHI.

**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 (Part I) : 2002 and IS 13920 : 1993 are allowed in the examination.

**Course Outcome:**

After successful completion of the course, the students will have the capability to design earthquake resistant structures and gained knowledge about seismic resistant construction practices.
13.805.2 WIND LOADING ON STRUCTURES (C) (Elective III)

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

Course Objective:
- To introduce in detail about the wind load computations on structures as per the Indian Standards
- To introduce the dynamic behavior of wind on structures
- To learn the wind load computations on structures of typical shape and special applications.

Module – I


Module – II

Wind pressure and static wind forces on buildings – pressure coefficients, internal and external pressure coefficients, local effects/coefficients. Force coefficients – buildings and individual members. Computation of static wind force on building envelops and other structures exposed to wind.

Module – III


Module – IV

Dynamic effect of wind on structures, galloping, fluttering and ovalling. Vortex shedding.

Calculation of wind load on special structures such as rail/road bridges, RCC/steel chimneys, overhead transmission line towers, natural draught cooling towers.

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 875 (part 3) is permitted in examination hall.

Course Outcome:

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

- Calculate the wind induced force on various structures
- Compute and compare the wind loads on different structures using different approaches outlined in IS code
- Compute wind load on special structures as per the relevant IS codes.
13.805.3 DEEP FOUNDATIONS (C) (Elective III)

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

Course Objective:

- To expose the students to the design of piles, pile groups and caissons with respect to vertical loads
- To enable the students to acquire proper knowledge about different types of deep foundations and its selection based on practical situations.

Module – I

Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – effect of pile installation on soil condition – criteria for pile socketing- Ultimate skin friction and end bearing capacity of single pile installed in granular soils based on SPT and CPT values- Basis of dynamic formulae- General comments on the reliability of dynamic formulae - The rational pile formula- Pile driving stresses- Conventional and cyclic pile load tests – Interpretation of field test and pile load test results.

Module – II

Piles for resisting uplift - Tension piles of uniform diameter in clays and sands - Tension piles with enlarged base in clays-under reamed piles-capacity and installation as per IS

Pile groups – Pile group configurations - Group action – Efficiency of pile groups - Group capacity – Minimum spacing of piles in a group – Negative skin friction of pile groups – Settlement of pile groups in clays – Equivalent raft approach - Settlement of pile groups in sands - Skempton’s and Meyerhof’s methods.

Module – III

Drilled piers- Types -construction Procedures-load transfer mechanism- estimation of load-bearing capacity in sand and clay-load carrying capacity based on settlement- uplift capacity of drilled piers.

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:

- Design deep foundations according to site requirement.
- Determine the load carrying capacity of different types of deep foundations.
13.805.4 EARTHQUAKE GEOTECHNICAL ENGINEERING (C) (Elective III)

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

Course Objective:
Understanding the basic seismology concepts; Estimation of liquefaction potential; Measurement of dynamic soil properties; Estimation of Bearing Capacity under seismic loading; Seismic design of retaining walls.

Module – I
Seismology and earthquakes (basic concepts only)- Earthquake hazards related to Geotechnical engineering- Wave propagation-Soil liquefaction-Suceptability,initiation and effects of soil liquefaction-Laboratory and field methods for estimation of liquefaction potential-CSR and CRR.

Module – II
Measurement of dynamic soil properties-Seismic reflection and seismic refraction tests-Seismic cross hole, down hole/uphold tests-SPT-High strain element tests-Cyclic tri-axial test-Shake table and centrifuge tests.

Module – III
Introduction to bearing capacity and settlement analysis under earthquake loading-Bearing capacity analysis for liquefied soil, Bearing capacity for granular soil with earthquake induced pore pressure, Bearing capacity analysis for cohesive soil weakened by earthquake, Seismic design consideration- Earthquake Provisions in building codes.

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 student will get an overall view of the nature of seismic hazards, the methods used to assess their impacts and the techniques available to mitigate their damaging effects.
13.805.5 URBAN WATER MANAGEMENT AND ENVIRONMENTAL HYDRAULICS (C) (Elective III)

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

Course Objective:

- To communicate the basic knowledge on urban flooding and its control measures
- To equip the students to perform the design of urban storm water drains
- To train the students to estimate the design flood and perform flood routing in channels
- To impart knowledge on pollutant transport through open channels and its modeling
- To impart knowledge on pollutant transport through soils
- To convey the basic knowledge on groundwater pollution.

Module – I

Urban hydrology – urban flooding-causes of flooding-Methods of flood warning, prevention and control-flood defense systems.
Intensity-duration – frequency relationships-Design storm and Probable Maximum Precipitation Design of urban storm water collection system-Gutters, inlets and sewers-rational formula-limitations-Storm water pollution and control (basic concepts)-Best management practices for urban drainage-constructed treatment wetlands (No design).

Module – II


Module – III

Module – IV

Contaminant propagation through soil-different mechanisms-hydraulic aspects of pollutant transport (basic ideas only)-Quality of groundwater- pollution of ground water-sources, distribution and evaluation of ground water pollution, cleaning of aquifers (Brief description only). Sea water intrusion-Ghyben-Herzberg equation-seawater freshwater interface-upconing preventive measures. Environmental impacts of different types of water resources projects-brief description only.

References:
9. Subramanya K., Engineering Hydrology, TMH Publishers

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:

- describe the causes of urban flooding and its control measures
- perform the design of urban storm water drains
- estimate design flood and perform flood routing in channels
- model the pollutant transport through open channels
- describe the mechanism of pollutant transport through soil
- describe the causes and remedies of groundwater pollution.
13.805.6 ENVIRONMENTAL IMPACT ASSESSMENT (C) (Elective III)

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

Course Objective:
To give an in-depth idea regarding the EIA methodology giving importance to environmental impact assessment techniques which are not covered in other environmental related subjects.

Module – I

Module – II
Elements of EIA – Purpose – Screening – Scoping - Terms of Reference - Public Consultation - Environmental Clearance process followed in India - Key Elements in 1994 & 2006 EIA (Govt. of India) Notification.

Module – III
Socio-economic impacts - Impact types- Identification- Impact assessment Methodologies- Overlays, Checklist, Matrices, Fault Tree Analysis, Event Tree Analysis- Role of an Environmental Engineer- Public Participation- Introduction to latest softwares in water and air quality Modeling.

Module – IV
Water Quality Analysis- Standards for Water, Air and Noise Quality - Impact of development on vegetation and wild life-Environmental Management Plan- EIA- Case study related to Hydro electric Project.

References:
5. John Glasson, Riki Therivel and S. Andrew Chadwick, *Introduction to EIA*, University College London Press Limited.
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 prepare an Environmental Impact Assessment report for a given developmental project.*
13.805.7 DESIGN AND CONSTRUCTION OF PAVEMENTS (C) (Elective III)

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

Course Objective:

To understand the basic principles of pavement design and applications of these principles in solving problems under varying circumstances in pavement design.

Module – I

Stresses in Flexible pavements- Elastic Layered systems- Boussinesq and Burmister’s theory, Two layer and three layer systems, Fundamental design concept; Vehicle and Traffic consideration in design-Fixed traffic and fixed vehicle, equivalent single wheel loads, equivalent axle load factors, Traffic wander, estimation of design traffic volume; Material input in pavement design- Resilient (Elastic) modulus of pavement materials; Flexible pavement design by IRC 37-2012.

Module – II


Module – III

Road Construction- Wet mix macadam, bituminous macadam, premix carpet, bituminous concrete. Highway drainage-principles of surface drainage-Design of cross section of drainage channel-sub surface drainage, base drainage, sub grade drainage.

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:** Use of IRC Codes given in References 4 and 5 are permitted in examination hall.

**Course Outcome:**

After successful completion of the course, the students will be able to propose quality pavement design to cater to the demand of the society.
13.805.8 REPAIR AND REHABILITATION OF STRUCTURES (C) (Elective III)

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

Course Objective:

- To introduce the causes of deterioration in structures and the need for maintenance
- To expose the students to diagnosis and assessment of deterioration using NDT
- To impart the methods of repair and rehabilitation of distressed structures.

Module – I

Causes of deterioration in concrete structures – errors in design, construction operations, earthquakes, erosion, chemical reaction, corrosion and durability.
Causes of deterioration in steel structures – corrosion, abrasion, loosening of connections, fatigue, impact, earthquakes and environmental problems.
Preventive measures, maintenance and inspection.

Module – II

Diagnosis and assessment of deterioration, visual inspection, non destructive tests, Ultrasonic pulse velocity method, Rebound hammer method, Pull out tests, Windsor probe test and crack detection techniques.

Module – III

Methods of repair of cracks, repairing spalling and disintegration, repairing concrete floors and pavements, repairing of corrosion damage of reinforced concrete, repair of steel structures.

Module – IV

Strengthening of existing structures, guniting, jacketing, use of chemicals, application of polymers, ferrocement and fibre concretes, pre-stressing, surface coatings, painting, water proofing, grouting, special repairs.

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

- Describe the various causes of deterioration of structures
- Diagnose, analyse and assess the deterioration of structures using NDT
- Decide the type of repair and the method of rehabilitation, most suited and economical for a distressed structure considering safety aspects.
- Compose the maintenance procedure to increase the durability of the structure
13.806.1 FINITE ELEMENT METHOD (C) (Elective IV)

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

Course Objective:
- To provide an understanding of fundamental knowledge and technique of Finite Element Method.
- To develop tools to analyse engineering problems using FEM and typical commercial FEA package.

Module – I


Module – II

Element properties- Displacement functions- Convergence requirements- Equilibrium and compatibility in the solution- Development of equilibrium equation- Types of finite elements- Development of shape functions for truss, beam and frame elements- CST, LST- Bilinear plane rectangular elements. Shape functions for C0 and C1 elements. Lagrangian and Hermitian Interpolation functions for one and two dimensional elements. Lagrange and Serendipity elements.

Module – III


Module – IV

Concept of Isoparametric formulation- Line element- Plane bilinear element- Subparametric and superparametric elements- Plane stress and plane strain problems- Patch test. Introduction to plate and shell elements- Types of 3D elements- Discussion of finite element packages.

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 build FEA model for various engineering problems.
- Gain confidence in learning and using new finite element packages.
13.806.2 DESIGN OF BRIDGES (C) (Elective IV)

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

Course Objective:  
To give a clear idea regarding the theory and design methods of various forms of bridges.

Module – I


Module – II

Pre stressed concrete bridges- Advantages-Introduction to various forms, Design of single span slab bridges- Design of end block.

Module – III

Steel bridges- Types of floor systems- Design of plate girder bridges- Design principles of horizontal truss bracings- end cross frames. Truss girder bridges-Types. Design principles of through type truss girder bridges for broad gauge railway.

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

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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. Design problems should be specific and the students should be able to answer within the stipulated time.


Course Outcome:

After successful completion of the course, the students will be able to select a particular form of bridge to suit the requirements and analyse, design the same.
13.806.3 REINFORCED EARTH (C) (Elective IV)

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

Course Objective:

*Detailed understanding of the history and mechanism of reinforced soil; Knowledge of the various types of geosynthetics, their functions and applications; detailed knowledge about the design of few reinforced soil structures.*

Module – I


Module – II


Module – III


Module – IV

Concept of Geocells, encased stone columns, prefabricated vertical drains, geocomposites, soil nailing, geotubes, geobags (only basic concepts). Natural geotextiles using coir and jute with relative advantages and disadvantages, application areas.

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:**

- Ability to adopt reinforced soil technique against conventional techniques; Ability to select suitable reinforcement material and type to suit the functional requirements;
- Carry out analysis and design of reinforced soil structures.
13.806.4 ADVANCED FOUNDATION ENGINEERING (C) (Elective IV)

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

Course Objective:
The student will be able to
- Design shallow foundations for eccentric loading using Meyerhoff’s method
- Evaluate the earth pressure behind retaining walls by graphical methods
- Evaluate the lateral load capacity of vertical piles by Brom’s approach
- Design cantilever and anchored sheet pile walls.

Module – I
Meyerhof’s method for estimation of bearing capacity of isolated footings (no derivation required) –
Effect of water table and inclination of loading on bearing capacity - Footings subjected to moments – eccentric loading – Solution using the two approaches proposed by Meyerhof.

Module – II
Graphical methods for lateral earth pressure on retaining walls - Active earth pressure (cohesion less backfill only) by Rebhann’s method & Culmann’s method— Advantages — Earth pressure on retaining walls with earthquake forces —layered backfills Extension of Coulomb’s theory (no derivation required)— locating safe distance of line load by Culmann’s method-Design of gravity retaining walls.

Module – III
Sheet pile walls – Types and uses and construction – Deflection diagram of cantilever sheet pile wall in sand- Analysis of cantilever sheet pile wall in granular and clayey soils-anchored bulkheads-fixed earth and free earth support method of analysis in cohesion less soil only.

Module – IV
Laterally loaded piles —fixed head and free headed piles- Ultimate lateral resistance and deflection of vertical piles in sand and clay by Brom’s approach – Methods to improve lateral stability of piles.

References:


**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.

**Note:** Use of Meyerhof’s and Brom’s charts are permitted in the examination. Assume any other suitable data if necessary.

**Course Outcome:**

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

- Design shallow foundations for eccentric loading using Meyerhoff’s method
- Evaluate the earth pressure behind retaining walls by graphical methods
- Design cantilever and anchored sheet pile walls
- Evaluate the lateral load capacity of vertical piles by Brom’s approach
13.806.5 IRRIGATION AND DRAINAGE ENGINEERING (C) (Elective IV)

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

Course Objective:
To understand the concept of irrigation water scheduling, distribution and system performance.

Module – I

Soil Plant Water relationships-soil physical properties influencing irrigation-kinds of soil water-movement of water into soils-infiltration and measurement-soil moisture retention and movement-soil moisture tension-total soil water potential-soil moisture characteristics-soil moisture constants-measurement of soil moisture-tensiometer, neutron moisture probe (only concepts). Plant water relationships- Crop response to water-moisture stress and plant response-drought tolerance-root characteristics and moisture use-evaporation, transpiration and consumptive use-measurement of evapotranspiration-Estimating evapotranspiration from evaporation and climatological data-methods (Blaney criddle, Thornthwaite, Penman and Christiansen only)-Crop co-efficient and evapotranspiration of a crop.

Module – II


Module – III

applications for design use of nomographs for homogeneous and layered soils – Earnst equation, concept of horizontal vertical and radial flow, application to layered soils.

Module – IV

Layout of open drainage systems, types- Field drains- design considerations of ditch drains-mole drains, design considerations, suitability- sub-surface drainage systems-pipe drainage systems- design for uniform and non- uniform flow conditions. Salinity and drainage-cause of salinity, salt balance equation, leaching efficiency, salt equilibrium equation and leaching requirement—salt storage equation –expressing equations in electrical conductivity terms. – Design of a drainage system for an irrigated area based on crop water requirement and leaching requirement.

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 concepts of irrigation practices and scheduling.
13.806.6 INDUSTRIAL WASTEWATER MANAGEMENT (C) (Elective IV)

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

Course Objective:
To impart knowledge on sources and characteristics of various industrial wastes and strategies for its treatment.

Module – I

Module – II
Stream quality criteria for water supply and aquatic life, Stream sanitation- deoxygenation and self purification of streams, re aeration constants, oxygen sag curve, Stream sampling, computation of waste loads on streams, Stream protection measures-stream standards and effluent standards.

Module – III
Theories of treatment - Neutralisation, acidification, causticisation and bascity factor, equalisation, proportioning -Removal of suspended solids and colloids, Removal of organic and inorganic dissolved solids, Separation of emulsions -emulsion breeding techniques-oil separation.

Module – IV
Industrial manufacturing process - Sources and characteristics of wastes and waste treatment methodologies for specific industries eg: Tannery waste, pulp and paper industry, textile industry, food processing industry, energy industry, iron and steel industry, toxic wastes.

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

- Identify the source of wastewater and categorize their characteristics
- Plan for minimizing the production of industrial waste
- Recommend the various methods for the treatment of industrial waste.
13.806.7 TRAFFIC ENGINEERING (C) (Elective IV)

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

**Course Objective:**

*The overall aim of the course is to provide fundamental knowledge of various surveys required in traffic engineering, traffic flow theory and its application, methods for capacity analysis, design, management, operation and safety.*

**Module – I**


**Module – II**

Traffic and Intersection Controls: Different types of traffic signs and markings, Types of intersections, Design considerations, Conflict areas at intersections, Traffic control devices, Warrants for installing traffic signal, Traffic signal- types and design, Warrants for interchanges, types of interchanges.

**Module – III**


**Module – IV**

Traffic variables and traffic flow theory (time-mean and space-mean speed, traffic flow and density, headways and spacing, fundamental diagram). Concept and definition of Passenger Car Unit, Introduction to Highway capacity, Level of service, Factors affecting capacity and level of service. Basic freeway capacity, Two lane highway capacities, Multilane highway capacity, capacity of weaving sections, capacity of rotary.

**References:**

6. Relevant IRC Codes

**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:**

On successfully completing this course, students will possess a good understanding of traffic engineering; know basic quantitative methods required by traffic engineers and the consequences for traffic engineering.
13.806.8 VALUATION OF REAL PROPERTIES (C) (Elective IV)

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

Course Objective:

- To understand the basic principles, methods and requirements of valuation of real properties
- To understand different types of depreciation and calculation, and how to use them in valuation process
- To understand rent fixation procedure for public and private buildings
- To prepare valuation reports in legal formats.

Module – I

Basic principles of valuation- Cost price and value- kinds of properties-Different purposes of valuation- kinds of values and definition-Factors affecting the value in general-Sources of valuation. Depreciation –Types, Methods of calculating depreciation- Obsolescence Replacement value- Depreciation value.

Module – II


Module – III

Valuation for banks- Different purposes-Collateral security and primary security- Mortgage-lease – easement
Valuation of commercial complex-Rent capitalization method- Valuation for - Rent fixation, taxation-Income tax, wealth tax, capital gain-Probate.

Module – IV

Procedure to become a valuer, Legal aspects of valuation, Valuation formats, Report writing procedure.


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 the course, the students will be able to:

- To calculate the depreciation and hence the depreciated cost or value of any property.
- To fix the rent for public and private buildings.
- To prepare valuation reports in legal format.
13.806.9 DESIGN OF PORT, HARBOUR AND COASTAL STRUCTURES (C)

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

Course Objectives:

- To impart basic knowledge in civil engineering aspects of Ports and Harbours.
- To familiarize the students in the areas of design aspects of port structures.

Module – I

The fundamentals: Wave conditions inside harbour, water circulation; breakwaters, jetties and quay walls; mooring, berthing and ship motion inside the port; Cargo handling – bulk material storage and handling.

Loads on Wharfs, Jetties, Dolphins. Live Load for different classes of Cargo - Dead load, Wind/ wave loads, Loads due to Crane Lateral loads Mooring & Berthing forces - fenders - Bollards

Module – II


Module – III

Breakwaters - Type and selection Criteria. Assessment of design input conditions. Environmental force, stability criteria. Design of Rubble mound, Caisson type, Vertical wall type. Different types of Armour units.

Module – IV

Design of port infrastructures with regards to (1) Cargo handling (2) Cargo storage (3) Integrated transport of goods, Planning multipurpose port terminals.

References

2. Seetharaman S., Construction Engineering and Management, 4/e, Umesh Publications, New Delhi, 1999

**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.

**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 wave theory, break water and various forces acting on coastal structures.
- Plan and design groynes, sea wall, harbour and offshore structures.


13.807 PROJECT AND VIVA-VOCE (C)

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

Course Objective:

- To provide motivation for the students to solve real world problems using mathematics and engineering principles.
- To motivate students to participate in group discussions and thereby exchange ideas.
- To serve as platform to identify research issues in existing systems.
- To impart the ability for project planning and also to develop the skill of implementing the ideas generated from the curricular components.

The project is aimed at improving the professional skill and competency of the students. Students groups may be formed with not more than five students in a group. Each group is expected to select a project in one of the current topics in Civil Engineering. A detailed project report in soft bound in an approved format is to be submitted at the end of the semester.

The performance of the students in the project work shall be assessed on a continuous basis by a panel consisting of the project coordinator, project guide, and two faculty members of the relevant subject group/ specialization. The project coordinator shall be the chairman of the panel.

There shall be at least an interim evaluation and a final evaluation of the project work. Each student in the group may give a power point presentation on the project work during the evaluation process. For the award of the sessional marks, the project report and the power point presentation of the project work shall be assessed. The students may be assessed individually and in groups.

Internal Continuous Assessment (Maximum Marks-200)

Marks for interim evaluation – 25%

Marks for final evaluation – 25%

Marks to be awarded by the project guide – 50%

The interim evaluation should be based on following criteria:

20%- Current relevance of the work, novelty and innovation, etc.
30%- Review of Literature and awareness to the work/topic
20% - Problem statement & Methodology
30% - Progress of the project - Implementation/experimentation of the work
The final evaluation should be based on following criteria:

25% - Involvement in the work
50% - Results & Quality of the project
25% - Project Presentation/ Demonstration

The mark awarded by the guide should be based on the following criteria:

25% - Subject knowledge
35% - Actual work (Applying subject knowledge to the work and putting research effort)
10% - Regularity in the class and active participation in discussions
10% - Team work
10% - Communication and documentation skills
10% - Project Report

University Examination Pattern:

Viva Voce

Maximum Total Marks: 100

Marks should be awarded as follows:

General topics covering Civil Engineering and other related/ advanced topics. - 50%
Project work - 35%
Seminar/ Survey camp/ Industrial visit - 15%

Course Outcome:

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

- Apply knowledge of mathematics, science and engineering principles to solve complex real world problems bringing out economically and socially feasible solutions upholding ethical values.
- Participate in peer group discussions and integrate ideas.
- Apply the knowledge base about advanced topics pertaining to area of study to design and implement solutions to challenging problems.
- Identify new research problems from issues raised during implementation.
- Communicate problems and solutions to society through reports.
- Manage time and resources effectively.