UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE
(2013 SCHEME)

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

#### V 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>CA Marks</th>
<th>Exam Duration Hrs</th>
<th>U E Max Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.501</td>
<td>Engineering Mathematics - IV (BCHMPSU)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.502</td>
<td>Environmental Engineering I (C)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.503</td>
<td>Structural Analysis II (C)</td>
<td>5</td>
<td>4 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.504</td>
<td>Geotechnical Engineering I (C)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.505</td>
<td>Transportation Engineering I (C)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.506</td>
<td>Water Resources Engineering (C)</td>
<td>4</td>
<td>3 1 -</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.507</td>
<td>Practical Surveying II (C)</td>
<td>2</td>
<td>- - 2</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>13.508</td>
<td>Concrete Lab. (C)</td>
<td>2</td>
<td>- - 2</td>
<td>50</td>
<td>3</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>29</strong></td>
<td><strong>19 6 4</strong></td>
<td><strong>400</strong></td>
<td><strong>800</strong></td>
<td><strong>1200</strong></td>
<td></td>
</tr>
</tbody>
</table>

1
Course Objective:

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

Module – I

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

Module – II

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

Module – III

**Linear programming** - Formation of LPP - General linear programming problem - Slack and surplus variables - Standard form - Solution of LPP - Basic solution - Basic feasible solution - Degenerate and non-degenerate solutions - Optimal solution - Solution by simplex method - Artificial variables - Big-M method.

Module – IV


References:


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

50% - Tests (minimum 2)

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

20% - Regularity in the class

**University Examination Pattern:**

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

The question paper shall consist of 2 parts.

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

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

**Course Outcome:**

After successful completion of this course, the students will be familiar with the large scale applications of linear programming techniques which require only a few minutes on the computer. Also they will be familiar with the concepts of probability distributions which are essential in transportation engineering.
Course Objectives:

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

**Module – I**


**Module – II**


**Module – III**

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

**Module – IV**

References


Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

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

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

Course outcome:

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

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

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

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

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


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


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

Module – IV
References:


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

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

**University Examination Pattern:**

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

The question paper shall consist of 2 parts.

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

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

**Course Outcome:**

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

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

Course Objective:

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

Module – I

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

Module – II


Module – III

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

Module – IV

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

References:
2002.

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

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

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

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

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

Course Outcome:

The students understand the basic principles governing soil behaviour; they
understand the procedure, applicability and limitations of various soil testing
methods.
Course Objectives:

- To impart knowledge in planning and design of railway tracks, rails, sleepers, points and crossings, track junctions, signals, control systems, stations and yards.
- To make the students aware of features and planning of harbour and harbour structures.

Module – I

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


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

Sleepers - Functions - Requirements - Types - Sleeper density.

Ballast - Functions - Requirements - Types - Ballastless tracks.

Module – II

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

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

Module – III

Points and Crossings - Necessity - Left and Right hand Turnouts - Switches - Types - Crossings - Design of turnouts.

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

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

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

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

Module – IV

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

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

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

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

Containerisation-Advantages-Planning of Container terminal.

Navigational Aids-Beacons-Buoys-Lighthouse-Lightships.

Moorings-Offshore moorings.

Dredging-Types-Choice of dredger

References:

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests *(minimum 2)*

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

20% - Regularity in the class

University Examination Pattern:

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

The question paper shall consist of 2 parts.

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

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

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

Course Outcome:

- After successful completion of the course, the students will possess knowledge on features of railway and harbour structures and shall be confident to take up the planning and design of various infrastructure components of railway and harbour structures.
Teaching Scheme: 3(L) - 1(T) - 0(P)  

Credits: 4

Course Objective:

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

Module – I

Hydrology-Hydrologic cycle - Precipitation types, forms, measurements-Computation of mean precipitation - rain gauge density and optimum number of rain gauges - water losses- Infiltration-measurement by double ring infiltrometer- Horton’s equation- infiltration indices.

Evaporation,-measurement by IMD Land pan. Runoff- Computation of runoff by different methods. Hydrograph (Sherman), Unit hydrograph and its applications-S- hydrograph.

Module – II

Planning of irrigation schemes-types of irrigation-lift and flow irrigation-Mode of irrigation water application-duty of water-soil water plant relationships-consumptive use (methods of estimation not required).-depth and frequency of irrigation water application-irrigation efficiencies.

Irrigation canals-types-canal alignment- Typical cross sections of unlined canals-Balancing depth. Design of canals on alluvial soils based on Kennedy’s theory and Lacey’s silt theory-canal lining-design of lined canals-Economics of canal lining.

Module – III

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

Module – IV

River Engineering-meandering-river training –objectives, classification, river training methods-levees, guide banks, groynes, artificial cut-offs, pitching, pitched islands (Design not necessary).

Stream flow measurement- velocity measurements-Computation of discharge (Area-velocity method)-rating curve (stage-discharge curve).
Reservoir—various types—zones of storage—storage capacity and yield—analytical and mass curve method—reservoir sedimentation—control of sedimentation—useful life of reservoir—computation.

References:


Internal Continuous Assessment (Maximum Marks-50)

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

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

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

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

Course Outcome:

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

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

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

List of Exercises:

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

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

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

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

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

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

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

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

Pre requisites:
- Basic Knowledge of 1) Building Technology (13.106)
- 2) Concrete Technology & Advanced Construction (13.304)

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

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

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

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

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

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

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

**University Examination Pattern:**

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

Questions based on the list of experiments prescribed.

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

20% - Viva voce  

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

**Course Outcome:**

- The students will become capable of supervising general concrete construction works.
- The understanding of quality control methods to be adopted in the construction site and capability of ensuring required standards will be acquired.