# DIPLOMA IN CIVIL ENGINEERING

## SCHEME OF INSTRUCTIONS AND EXAMINATIONS

### FIRST YEAR

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Instruction period / week</th>
<th>Total Period / year</th>
<th>Scheme of Examination</th>
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<td>Theory</td>
<td>Practical /Tutorial</td>
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<tr>
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<td>CE-103</td>
<td>Engineering Physics</td>
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<td>CE-107</td>
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<td>CE-108</td>
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ENGINEERING MECHANICS

Subject Title : Engineering Mechanics
Subject Code  : CE-105
Periods/Week  : 05
Periods/Semester : 150

TIME SCHEDULE

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<th>Short Answer Type</th>
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OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Know the basic concept of Engineering Mechanics
   1.1 Define Mechanics and Engineering Mechanics
   1.2 State the applications of Engineering Mechanics
   1.3 State the branches of Engineering Mechanics
   1.3 Define Statics, Dynamics, Kinetics and Kinematics
   1.4 State systems of measurements and Units
   1.5 Know S.I and M.K.S units of physical quantities used in Civil Engineering

2.0 Understand Equilibrium of Co-Planer forces
   2.1 Define: Force, Moment, Resultant, Equilibrium of forces; equilibrant and Moment of a couple.
   2.2 Distinguish between Scalar and Vector quantities, Co-planar and non-co-planar forces, parallel and non-parallel forces, like and unlike parallel forces.
   2.3 Compute the resultant of two co-planar forces acting at a point by law of parallelogram of forces and Triangle law of forces, concept of Lamis theorem.
2.4 Compute the resultant of a system of coplanar concurrent forces by law of polygon of forces and by resolution.
2.5 Compute the resultant of a system of coplanar parallel forces.
2.6 Explain the properties of a couple.
2.7 State the condition of equilibrium of rigid body subjected to a number of co-planar forces.
2.8 Determine resultant of co-planar concurrent forces by analytical methods.
2.9 List various types of supports
2.10 List various types of beams
2.11 List various types of loading
2.12 To determine support reactions for simply supported beams with point loads and Uniformly distributed loading

3.0 Understand Centre of gravity and Centroid

3.1 Define Centroid, Centre of gravity and Centre of mass
3.2 State the necessity of finding the Centroid and Centre of gravity for various engineering applications.
3.3 Calculate positions of centroids for simple plane figures from first principles
3.4 Explain the method of determining the Centroid by ‘Method of moments’.
3.5 Determine the position of centroids of standard sections-T,L,I,Channel section, Z section, unsymmetrical I section
3.6 Determine the position of centroids of built up sections consisting of RSJ’S and flange plates and Plane figures having hollow portions

4.0 Understand Moment of Inertia and radius of gyration
4.1 Define Moment of Inertia, Polar Moment of Inertia, Radius of gyration
4.2 State the necessity of finding Moment of Inertia for various engineering applications
4.3 Determine moment of Inertia and Radius of gyration for regular geometrical sections.
4.4 Determine MI of standard sections by applying parallel axes theorem.
4.5 Determine MI of built-up sections by applying parallel axes theorem.
4.6 Calculate radius of gyration of standard sections.
4.7 Determine the polar MI for solid and hollow circular section applying perpendicular axes theorem.

5.0 Understand Behaviour of Materials under simple Stresses and Strains
5.1 Define terms: Stress, strain, Modulus of Elasticity, Longitudinal Strain, Lateral Strain, Poisson’s ratio, Modulus of rigidity, Bulk Modulus, working stress, Factor of safety, Resilience, Strain Energy, proof Resilience, Modulus of Resilience.
5.2 Distinguish between different kinds of stresses and strains.
5.3 Explain the salient points in stress-strain curve for ductile materials (Mild steel).
5.4 State Hooke’s law and limits of proportionality.
5.5 Solve problems on relationship between simple stress and simple strain under axial loading on uniform bars and stepped bars.
5.6 State the relationship between the elastic constants.
5.7 Solve problems on relationship between elastic constants.
5.8 Calculate stresses in simple and composite members under axial loading
5.9 Explain temperature stress, strain, hoops stress, temperature stresses in composite sections.
5.10 Calculate instantaneous stress and strain Energy due to dynamic loads and impact loading.
5.11 Explain the mechanical properties of materials.

COURSE CONTENT

1. Introduction

2. Forces & Moments
a) Definition of force; vectors and scalars; vector representation of a force; systems of forces; co-planar forces.
b) Resultant of forces at a point – Parallelogram Law and Triangle Law of forces – Lami’s theorem – Polygon law of forces – Resolution of forces.
c) Parallel forces – like and unlike – moment of force-its units and sense-couple-moment of a couple – properties of a couple.
d) Conditions of equilibrium of a rigid body subjected to a number of co-planar forces.
e) Structural members supporting co planar forces- Types of supports-Types of beams- Types of loading- Determination of support reactions for simply supported beams with point loads and Uniformly distributed loading

3. Centre of gravity and Centroid
a) Definitions – Centre of gravity and Centroid
b) Position of centroids of standard plane figures like rectangle, triangle, parallelogram circle, semi-circle and trapezium.
c) Determination of location of Centre of gravities of standard sections- T, L, I, Channel section, Z section and built up sections consisting of RSJ’s and flange plates and plane figures having hollow portion.

4. Moment of Inertia
a) Definition of Moment of Inertia
b) Perpendicular and parallel axes theorems
c) Moment of Inertia of standard sections like rectangle, triangle, circle and hallow circular sections
d) Moment of Inertia of built up sections- T, L, I, Channel section, and Z sections using parallel axis theorem
e) Moment of Inertia and radius of gyration of built-up sections consisting of the combinations of RSJ’s flange plates, channels & flange plates etc.
f) Polar Moment of Inertia of solid and hallow circular sections using perpendicular axis theorem
5. **Simple Stresses and Strains**
   a) Stress and strain – type of stresses and strains
   b) Stress strain curves for ductile materials- mild steel, elastic limit, limit of proportionality, yield point, ultimate stress; breaking stress; working stress factor of safety.
   c) Hooke’s law – Young’s modulus – deformation under axial load.
   d) Shear stress and Shear Strain – Modulus of rigidity.
   e) Longitudinal and lateral strain-poisson’s ratio Bulk Modulus – relationship between elastic constants (proof not required, only problems).
   f) Composite sections – effect of axial loads
   g) Temperature stresses – strains – hoop stress - Temperature stresses in composite sections
   h) Resilience – strain energy-proof resilience – and modulus of resilience – maximum instantaneous stress due to gradual, sudden, and shock loading.
   i) Mechanical properties of materials-elasticity, plasticity, ductility, brittleness, malleability, stiffness, hardness, toughness, creep, fatigue, examples of materials which exhibit the above properties.

**REFERENCE BOOKS**

SURVEYING – I

Subject Title : Surveying – I  
Subject Code : CE-106  
Periods/Week : 03  
Periods/Year : 90

TIME SCHEDULE

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<th>S. No.</th>
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<th>Short Answer Type</th>
<th>Essay type</th>
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</table>

OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Know the basic facts about Surveying
   1.1 State the concept of surveying.
   1.2 State the purpose of surveying.
   1.3 Distinguish between Plane and Geodetic surveying.
   1.4 State the units of linear and angular measurements in Surveying and conversions.
   1.5 State the instruments used for taking linear and angular measurements.
   1.6 State and explain the classification of surveys.
   1.7 State and explain the fundamental principles in surveying.
   1.8 State and explain the stages of survey operations.

2.0 Understand the principles of Chain Surveying
   2.1 State the purpose and principle of Chain surveying.
   2.2 Explain the principles used in Chain triangulation.
   2.3 Explain the functions of different instruments used in Chain Surveying.
   2.4 List the points to be followed while selecting the survey stations
   2.5 Explain the methods of ranging a line.
   2.6 List the operations involved in chaining on flat and sloping ground and when high ground intervenes.
   2.7 Describe the method of setting out right angles with or without cross staff and Optical square.
   2.8 Explain the field work procedure in Chain survey and method of recording field observations.
   2.9 Know the errors and mistakes in Chain surveying.
   2.10 Determine the corrections for measurement due to incorrect length of chain.
2.11 Explain the methods of overcoming different obstacles in chain surveying.
2.12 Explain the method of preparing site plans by Chain Surveying.
2.13 Calculate the areas of irregular boundaries using Average Ordinate rule, Trapezoidal rule and Simpson’s rule.

3.0 Principles of Compass Surveying
3.1 State the purpose and principles of Compass surveying.
3.2 Identify the parts of Prismatic Compass and state their functions.
3.3 Define terms-Whole Circle Bearing, Quadrantal Bearing, True meridian, magnetic meridian, true bearing, magnetic bearing, Dip, Declination, Local attraction.
3.4 Convert Whole Circle Bearing, Quadrantal Bearing and vice versa.
3.5 Explain local attraction and its effect.
3.6 Determine corrected bearing for local attraction.
3.7 Compute the included angles and true bearings of lines in a Compass traverse.
3.8 Explain the operations involved in field in compass Surveying
3.9 Explain methods of recording field notes.
3.10 Explain the method of plotting Compass Surveying.
3.11 Explain the method of plotting closed traverse and adjusting closing error by Bowditch rule.
3.12 State the errors in Compass surveying.

4.0 Uses and working principles of Minor Instruments
4.1 State the necessity of using Minor instruments
4.2 List various minor instruments in surveying
4.3 Explain the uses and working principles of Abney Level, Pentagraph and Electronic Planimeter
COURSE CONTENT

Classification and Principles of Surveying  
  a) Concept of Surveying-purpose of Surveying-Divisions of surveying- Classification of Surveying based on different criteria– Fundamental principles in Surveying -Measurements- Units and conversions-Instruments used for taking linear and angular measurements- Stages of survey operations-Field work, Office work, Care and adjustments of the instruments.

Chain Surveying  
  a) Purpose and Principle of Chain Survey ing -Suitability of Chain Surveying-Survey stations and their selection-Survey lines and offsets – Instruments used in Chain survey and their function

  b) Ranging a survey line- direct ranging and Indirect ranging – Line ranger-Chaining a line –Duties of leader and follower- Chaining on a sloping ground-Errors and mistakes in ordinary chaining -Correction due to incorrect length of Chain-problems

  c) Different operations in Chain Surveying- Setting out right angles with cross staff and Optical square- Cross staff survey

    Field work procedure- Recording field notes – field book- Conventional signs.

  d) Obstacles in chaining-methods to overcome obstacles-Problems

  f) Calculations of area – different methods –Average ordinate, Trapezoidal and Simpson’s rules.

Compass Surveying  
  a) Introduction, Purpose, principle and uses of compass Survey-Traverse-Open and Closed Traverse –Theory of magnetism-Description working and use of Prismatic compass-Operations in using Compass before taking readings

  b) Concept of Meridian-Types of meridians-Bearing and angle- Designation of bearings- Whole Circle Bearing. Quadrantal Bearing

  Conversions-

  c) Field work in Compass Survey –field notes-traverse using prismatic compass.

  d) Local attraction-detection and correction, Dip and Magnetic declination- Variation of Magnetic declination-calculation of true bearings-Determination of included angles from the given bearings and vice versa in compass traverse.

  e) Plotting of Compass traverse-closing error and adjustments by Bowditch graphical method.

  f) Precautions in using a Compass-Errors in Compass Surveying..

Minor instruments  
  Purpose of Minor instruments- Various minor instruments- Uses and working principles of Abney Level, Pentagraph and Electronic Planimeter
REFERENCE

1. Surveying by N.N.Basak (Tata Mc Graw Hill)
3. Surveying and levelling Vol –1 by KULKARNI and KANETKAR
4. Surveying and Levelling Vol. – 1 - B.C. PUNMIA.
5. Surveying and Levelling - Vol –1 by R.AGOR (Khanna Publishers)
ENGINEERING DRAWING

Subject Title : Engineering Drawing
Subject Code : CE– 107
Periods/Week : 06
Periods per Year : 180

TIME SCHEDULE

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OBJECTIVES

After completion of the subject the student should be able to

1.0 Understand the Importance of Engineering Drawing
   1.1 State the importance of drawing as an engineering communication medium.
   1.2 State the necessity of I.S. Code of practice for Engineering Drawing.
   1.3 Appreciate the linkages between Engineering drawing and other subjects of study in Diploma course.

2.0 Understand the use of Engineering Drawing Instruments
   2.1 Select the correct instruments and draw lines of different orientation.
   2.2 Select the correct instruments and draw small and large Circles.
   2.3 Select the correct instruments for measuring distances on the drawing.
   2.4 Use correct grade of pencil for different types of lines, thickness and given function.
   2.5 Select and use appropriate scales for a given application.
   2.6 Identify different drawing sheet sizes as per I.S. and Standard Lay-outs.
2.7 Prepare Title block as per I.S. Specifications.
2.8 Identify the steps to be taken to keep the drawing clean and tidy.

3.0 Write Free Hand Lettering and Numbers
3.1 Write titles using sloping lettering and numerals as per B.I.S (Bureau of Indian standards)
3.2 Write titles using vertical lettering and numerals as per B.I.S.
3.3 Select suitable sizes of lettering for different layouts and applications.
3.4 Make the use of lettering stencils.

4.0 Understand Dimensioning Practice
4.1 State the need of dimensioning the drawing according to accepted standard.
4.2 Define “Dimensioning”.
4.3 Identify notations of Dimensioning used in dimensioned drawing.
4.4 Identify the system of placement of dimensions in the given dimensioned drawing.
4.5 Dimension a given drawing using standard notations and desired system of dimensioning.
4.6 Dimension standard features applying necessary rules.
4.7 Arrange dimensions in a desired method in a given drawing.
4.8 Identify the departures if any made in the given dimensioned drawing with reference to SP-46 - 1988, and dimension the same correctly.

5.0 Apply Principles of Geometric Constructions
5.1 Divide a given line into desired number of equal parts internally.
5.2 Draw tangent lines and tangent arcs.
5.3 Construct a Hexagon from the given data.
5.4 Define ellipse, parabola, hyperbola, involute, cycloid and helix.
5.5 Construct ellipse by concentric circles method and using a paper trammel.
5.6 Construct parabola, rectangular hyperbola, involute, cycloid and helix from the given data.
5.7 State the applications of the above constructions in engineering practice.

6.0 Apply Principles of Projection of points, lines & planes
6.1 Explain the projection of a point with respect to reference planes (HP & VP)
6.2 Explain the projections of straight lines with respect to two reference planes.
6.3 Explain the projections of perpendicular planes.

7.0 Apply principles of Orthographic Projection
7.1 Explain the principles of Orthographic projection with simple sketches.
7.2 Prepare orthographic views of a given simple Engineering part in first angle projection.
7.3 Draw the orthographic views of an object, given its pictorial drawing.
7.4 Sketch the minimum number of views needed to represent a given object fully.
7.5 Identify the object, from a number of orthographic views given.
7.6 Supply the missing view when two other views of an object are given.

8.0 Appreciate the need of Sectional Views
8.1 Explain the need to draw sectional views.
8.2 Select the section plane for a given component to reveal maximum information.
8.3 Draw sectional view for the component in 8.2.
8.4 Apply conventional practices and identify the parts, which should not be shown in section while drawing sectional views.
8.5 Make conventional representation of Engineering materials as per latest B.I.S. Code.
8.6 Apply principles of hatching.
8.7 Draw simple sections (full, half, revolved and removed part) for a range of simple Engineering objects.
8.8 Draw the component from a given set of sectional views.

9.0 Understand the need for Auxiliary Views
9.1 State the need of Auxiliary views for a given Engineering Drawing.
9.2 Sketch the auxiliary views of a given Engineering component to indicate the true shape and size of component.
9.3 Draw the auxiliary views of a given object or set of orthographic views.

10.0 Prepare Pictorial Drawings
10.1 State the need for commonly used type of pictorial drawings.
10.2 Given the objects, draw their orthographic views.
10.3 State the need of isometric scale and isometric projection.
10.4 Prepare Isometric projections and isometric views for the given orthographic drawings.
10.5 Prepare oblique drawing (cavalier, cabinet) of simple Engineering objects from the given data.
10.6 Identify the correct pictorial views from a set of Orthographic drawings.

11.0 Prepare Development Drawings
11.1 State the need for preparing development drawing.
11.2 Prepare development of simple Engineering objects using parallel line and radial line method.
11.3 Prepare development of surfaces of Engineering components like trays, funnels, 90° elbows & rectangular ducts.

COURSE CONTENT

NOTE:
1. I.S. / B.S Latest Specification should invariably be followed in all the topics.
2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

1.0 Understand the importance of Engineering Drawing
Explanation of the scope and objectives of the subject of Engineering Drawing and its importance as a graphic communication
Need for preparing drawing as per standards – SP-46 – 1988
Link between Engineering drawing and other subjects of study.

2.0 Engineering drawing Instruments
Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mentioning of names under each classification and their brief description – Scales:
Recommended scales – reduced & enlarged – Lines: Types of lines, selection of line thickness – Selection of Pencils – Sheet Sizes: A0, A1, A2, A3, A4, A5 – Layout of drawing sheets in respect of A0, A1, A3 sizes – Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet – To draw “Lay out of sheet as per SP-46-1988 to a suitable scale.
Simple Exercises on the use of Drawing Instruments.
Importance of Title Block.

**Drawing Plate 1: (Consisting of about two exercises)**

To draw geometric shapes (standard) using drawing instruments
To draw layout of sheet and title block.

### 3.0 Free hand lettering & numbering

Importance of lettering – Types of lettering – Guide Lines for Lettering – Recommended sizes of letters & numbers – Advantages of single stroke or simple style of lettering – Use of lettering stencils

**Drawing plate 2: (Consisting of about 5 to 6 exercises)**

To print the table of Types of lines as per latest ISI Standards.
To print the table of “Recommended sizes of letters and numerals” – as per Standards.
Selection of suitable size of letters and numbers and draw the given titles, phrases using both vertical and sloping styles.

### 4.0 Dimensioning practice

Purpose of engineering Drawing – need of I.S.I code in dimensioning – Shape description of an Engineering object -Definition of Dimensioning size description – Location of features, surface finish, fully dimensioned Drawing – Notations or tools of dimensioning, dimension line extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools – Placing dimensions: Aligned system and unidirectional system (SP-46-1988)-Arrangement of dimensions – Chain, parallel, combined, progressive, and dimensioning by co-ordinate methods – The rules for dimensioning standard, features “Circles (holes), arcs, angles, tapers, chamfers, and dimensioning of narrow spaces.

**Drawing Plate 3: (Consisting of above 12 to 15 exercises)**

Dimensioning a given drawing using the above tools, rules and systems of dimensioning.
Dimensioning practice in various methods of dimensioning stated above.
Dimensioning, given common features listed.
Exercise in identifying the departures made in a given dimensioned drawing from I.S.I. Code of practice.

### 5.0 Geometric Construction

**Division of a line:** to divide a straight line into given number of equal parts internally – examples in Engineering application.
Construction of tangent lines: to draw tangent lines touching circles internally and externally.

**Construction of tangent arcs**

i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles).

ii) Tangent arc of given radius touching a circle or an arc internally or externally and a given line.

iii) Tangent arcs of radius R, touching two given circles internally and externally.

**Hexagon:** Inscribing a Hexagon in a circle of given diameter and circumscribing about a given circle, using

i) Set squares.

ii) Compass – given a side to construct a Hexagon using set squares or compass.

**Conical Curves:** Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci of a moving point, Eccentricity of above curves – Their Engineering application viz. Bolts and Nuts, Projectiles, reflectors P.V. Diagram of a Hyperbolic process – Construction of Ellipse using

i) Concentric circles method.

ii) Paper trammel method.

iii) Construction of parabola by rectangular method.

iv) Construction of Rectangular Hyperbola when the position of a point on the curve is given.

**General Curves:** Involute, Cycloid and Helix – explanations as locus of a moving point, their Engineering application, viz, Gear tooth profile, screw threads, springs etc. and their construction:

**Drawing Plate: 4 (Consisting of about 12 to 15 exercises)**

Exercises mentioned above at the rate of at least one problem on each “construction”.

### 6.0 Projection of points, lines and planes

Projecting a point on two planes of projection – Projecting a point on three planes of projection

Projection of straight line.

(a) Parallel to one or both the planes.

(b) Contained by one or both the planes.

(c) Perpendicular to one of the planes.

(d) Inclined to one plane only and parallel to other plane.

Projection of perpendicular planes

(a) Plane perpendicular to both HP and VP

(b) Plane perpendicular to HP and parallel to VP and Vice versa.

(c) Plane perpendicular to HP and inclined to VP and vice versa.

Projection of Regular solids in simple positions

### 7.0 Orthographic Projections

Meaning of Orthographic Projection – Using a viewing Box and a model – Number of views obtained on the six faces of the box – Neat sketches of only 3 views for describing object – Concept of front view, top view, and side views – sketching these views for a number of Engineering objects – Explanation of “First angle projection”.

I-14
Positioning of three views in First angle projection – Projection of points as a means of locating the corners of the surfaces of an object – Use of miter line in drawing a third view when other two views are given – Method of representing hidden lines – Selection of minimum number of views to describe an object fully.

**Drawing Plate 5: (Consisting of about 10 to 12 Number of exercises)**

- Given an engineering object(s) to sketch the three views.
- Given the pictorial view of simple objects to sketch the three views in First and third angle projections.
- Given the object (pictorial Drawing) and 3 views identifying the surface on the views with reference to the object.
- Given two views of a simple object – Draw the missing third view.

**Drawing Plate 6: (Consisting of about 6 to 8 exercises)**

- Given the engineering objects (Pictorial views) Drawing the three views in First angle projection.
- Identifying the object, when a number of objects and the orthographic views are given (matching exercises).

### 8.0 Sectional views

- Need for drawing sectional views – what is a sectional view - Location of cutting plane
- Purpose of cutting plane line – Selection of cutting plane to give maximum information (vertical and offset planes) – Meaning of Full, half, revolved and removed, local or partial sections – Hatching – adjacent components (two or more) large areas, a part in different parallel planes – Conventional practices to represent sections of ribs, shafts, bolts, nuts, screws, rivets, spokes, webs, keys, cotters, thin sections etc., as per B.I.S. specifications – Conventional representation of materials as per B.I.S. Standards.

**Drawing Plate 7: (Consists of about 8 to 10 exercises)**

- Preparing conventional representation of materials as per latest / B.I.S. Code.
- Given the object (pictorial or orthographic view), and cutting plane line to draw sectional view.
- Given the object to select the correct cutting plane line and then to draw the sectional view.
- To identify the object when number of objects and number of sectional views are given (Matching exercise.)

### 9.0 Auxiliary views

- Need for drawing auxiliary views – Explanation of the basic principles of drawing an auxiliary view – explanation of reference plane and auxiliary plane – Partial auxiliary view.

**Drawing plate No.8: (Consisting of about 8 exercises)**

- Given a set of objects or orthographic views state whether an auxiliary view is needed – if required sketch the same.
- Given the object and its auxiliary view (partial or full, to sketch the auxiliary plane on the pictorial view)

### 10.0 Pictorial Drawings

- Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective – Use of the pictorial drawings – Isometric drawings: Isometric axes, angle between them, meaning of visual distortion in dimensions – Need for an isometric scale, difference between Isometric scale and ordinary scale, difference between Isometric drawing (isometric view and Isometric Projection) and orthographic
drawing – Isometric and non-Isometric lines – Isometric drawing of common features like rectangular, square and circular shapes – non-isometric lines – Use of box and offset construction – Oblique drawings: Their use – Cavalier and cabinet drawings – Oblique drawing of common features like rectangular, circular and inclined, surfaces – Selection of the face of the object to be included in the front view.

**Draw plate 9: (Consists of about 10 to 12 exercises)**

Given the Orthographic views to draw isometric views
Construction of isometric scale
Given the Orthographic views to draw isometric projections
Given the Orthographic views to draw cavalier Drawings
Given the Orthographic views to draw cabinet Drawings

**11.0 Development of Surfaces**

Need for preparing development of surface with reference to sheet metal Work – Concept of true length of a line with reference to its Orthographic projection when the line is (i) parallel to the plane of projection (ii) When it is inclined to one principal and parallel to the other – Development of simple Engineering common solids like Cubes, prisms, Cylinders, Cones, Pyramid (sketches only) – Types of Development: Parallel line and radial line development – Procedure of drawing development of surfaces of trays, funnels, 90° elbow pipes and rectangular ducts.

**Drawing plate No. 10: (Consists of about 10 exercises)**

Development drawings by “Parallel – line” method such as prisms and Cylinders (Truncated)
Development drawing by “Radial – line” method such as cones and pyramids (Truncated)
Development drawings of a tray, funnel, 90° elbow and rectangular duct

**REFERENCE**

SURVEY-I PRACTICE & PLOTTING

Subject Title : Survey – I practice & plotting
Subject Code : CE-108
Periods/Week : 06 (4+2)
Periods/Year : 180

TIME SCHEDULE

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<th>No. of Periods</th>
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<td>1.</td>
<td>Chain surveying</td>
<td>60</td>
</tr>
<tr>
<td>2.</td>
<td>Compass Surveying</td>
<td>60</td>
</tr>
<tr>
<td>3.</td>
<td>Minor instruments</td>
<td>12</td>
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<tr>
<td>4.</td>
<td>Plotting</td>
<td>48</td>
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SKILLS

After completion of the practice and plotting, the student shall be able to

1.0 **Apply standard Practices to perform chain survey in the field and to plot from field data**

1.1 Practice unfolding and folding a chain.
1.2 Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book.
1.3 Perform direct ranging on level ground and measure the distance between two given stations using line ranger.
1.4 Perform indirect ranging and measure the distance between two given stations when a high ground intervenes to prevent intervisibility of ends of line.
1.5 Set out a right angle to a given chain line by using chain only.
1.6 Set and measure offsets - perpendicular offsets and oblique offsets for a given chain line.
1.7 Perform triangulation survey of a given area with chain and cross staff and record all necessary nearby details.
1.8 Calculate the area bounded by the given points by chain triangulation and compare the result with the area calculated from plotting.
1.9 Carry out chain survey to overcome obstacles like pond, building etc and plot the Survey from field book measurements.
1.10 Carry out chain traversing to survey an area bounded by more than three stations and plot the Survey from field book measurements.

2.0 **Apply Principles to Perform compass survey and plot from field data**

2.1 Identify the parts of a prismatic Compass
2.2 Set up the compass at a station and carry out temporary adjustments.
2.3 Take bearings of two points from instrument station and calculate the included angle.
2.4 Perform an open compass survey with Compass and Chain.
2.5 Perform a closed traverse with compass and chain.
2.7 Plot the closed traverse from field data and adjust for closing error by Bowditch rule.
2.8 Determine the area bounded by the given points by the method of Radiation.
2.9 Determine the distance between two accessible points involving single setting of the instrument.
2.10 Determine the distance between two inaccessible points involving setting of the instrument at two stations.

3.0 Learn from demonstration of various minor instruments
3.1 Demonstrate Abney level for taking angle of elevation and depression
3.2 Demonstrate Pentagraph to reduce and enlarge a given map and drawing.
3.3 Demonstrate Electronic Planimeter for measuring areas of irregular shape.

4.0 Apply principles of mapping from the field work and plot the from the field work measurements.
4.1 Understand the importance and relation between field work and plotting.

**Key competencies to be achieved by the student**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Experiment title</th>
<th>Key competency</th>
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<tbody>
<tr>
<td>1</td>
<td>Practice unfolding and folding of a chain</td>
<td>Holding both the handles in the left hand and throwing the chain swiftly with the right hand in the forward direction.</td>
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</tbody>
</table>
| 2    | Ranging a survey line by direct ranging and determining the distance between two points | a) Fixing of ranging rod in the ground  
b) Ranging by eye |
| 3    | Ranging a survey line by a line ranger | a) Observing the images of the ranging rods A and B in upper and lower prisms at the same time.  
b) Moving the instrument backward and forward at right angles to the line until two images appear one above the other exactly in the same vertical line. |
| 4    | Ranging a survey line by indirect ranging and determining the distance between two points | Ensure that the ranging rods at end stations are visible from the selected intermediate positions |
| 5    | Setting and measuring perpendicular and oblique offsets | a) Measuring the chainage accurately  
b) Holding the cross staff vertically and |
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<td></td>
<td>Viewing both the slits to coincide with chain line and object line.</td>
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<tr>
<td></td>
<td>Measuring the length of Oblique offsets accurately.</td>
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<tr>
<td>6</td>
<td>Calculation of area of a given boundary by Cross staff survey</td>
<td>Run the chain line through the centre of the field.</td>
</tr>
</tbody>
</table>
| 7 | Perform triangulation survey of a given area with chain and cross staff. | a) Measuring the length of base line accurately  
b) Measuring the offsets correctly  
c) Recording the field work observations correctly |
| 8 | Perform chain traverse survey of a given area with chain and cross staff. | a) Selecting main survey stations at the ends of the chain lines should be intervisible  
b) Measuring the length of base line accurately  
c) Measuring the offsets correctly  
d) Recording the field work observations correctly |
| 9 | Set up the compass at a station and carry out temporary adjustments | a) Fixing the compass with tripod stand  
b) Centering the compass  
c) Leveling the compass |
| 10 | Calculation of included angles from a given bearings | a) Observing the bearings correctly  
b) Detection of local attraction if any |
| 11 | Perform an open compass survey with Compass and Chain | a) Measure the fore and back bearings of the traverse legs by Prismatic compass after fixing the local magnetic meridian |
| 12 | Perform a closed compass survey with Compass and Chain and adjust for closing error by Bowditch method. | a) Verify the observed bearings and apply the necessary corrections for local attraction  
b) Adjust the closing error |
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<tr>
<td>13</td>
<td>Determine the area bounded by the given points by the method of Radiation</td>
<td>Calculate included angles from a given bearings and check for sum of included angles</td>
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<tr>
<td>14</td>
<td>Determine the distance between two accessible points involving single setting of the instrument</td>
<td>Locate a point from which both the accessible points are visible.</td>
</tr>
<tr>
<td>15</td>
<td>Determine the distance between two inaccessible points involving setting of the instrument at two stations</td>
<td>Select at least two accessible and intervisible stations and measure the distance and take the bearings</td>
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<tr>
<td>16</td>
<td>Demonstrate Abney level for taking angle of elevation and depression</td>
<td>a) To measure the vertical angle by directing the instrument towards the object and exactly bisecting with cross wires [b)] To measure the slope of the ground</td>
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<tr>
<td>17</td>
<td>Demonstrate Pentagraph to reduce and enlarge a given map and drawing.</td>
<td>Keep the arms in such a way that the two arms are kept equal and for every position, the two arms should form and remain a parallelogram</td>
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<tr>
<td>18</td>
<td>Demonstrate Electronic Planimeter for measuring areas of irregular shape.</td>
<td>Moving the tracing point gently and exactly along the boundary line</td>
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</table>

**COURSE CONTENT**

**Chain Surveying**
- a) Practice unfolding and folding of a chain.
- b) Ranging and chaining of lines on level ground and recording in field book to measure the distance between two stations.
- c) Ranging a survey line using a line ranger
- d) Chaining a line involving indirect ranging.
- e) Setting and measuring the offsets-Perpendicular and Oblique offsets
- f) Measurement of land areas-correct staff survey
- g) Chain triangulation around the building covering a small area with other details taking offsets and recording.
- h) Chain triangulation involving a road with other details taking offsets and recording.
- i) Chain traversing to survey an area bounded by more than three stations.

**Compass Surveying**
- a) Setting up the compass – observations of bearings
- b) Calculation of included angles from the observed bearings
c) Traversing with prismatic compass and chain – open Traverse – Recording.
d) Traversing with prismatic compass and chain - closed traverse - recording.
e) Plotting the closed traverse from field data and adjust for closing error by Bowditch rule.
f) Determination of the area bounded by the given points by the method of Radiation
g) Determination of the distance between two accessible points involving single setting of the instrument
h) Determination of the distance between two inaccessible points involving setting of the instrument at two stations.

Minor Instruments
a) Demonstration of Abney level for taking angle of elevation and depression
b) Demonstration of Pentagraph to reduce and enlarge a given map and drawing.
c) Demonstration of Electronic Planimeter for measuring areas of irregular shape.

Plotting

a) Conventional signs in Surveying 2 Exercises
b) Plotting of perpendicular and oblique offsets 1 Exercise
c) Plotting of land surveys – Chain and cross-staff Surveying – Calculation of areas 4 Exercises
d) Plotting of chain triangulation 4 Exercises
Surveying of small areas around Buildings.
e) Chain traversing to survey an area bounded by more than three stations 2 Exercises
f) Plotting of closed traverse by Compass surveying – location of Details and adjusting error by Bow ditch method. 3 Exercises
f) Plotting of open traverse by Compass surveying and locating details 2 Exercises.
g) Compass survey by method of radiation-calculation of area 1 Exercise
h) Determination of the distance between two accessible points involving single setting of the instrument 1 Exercise
I) Determination of the distance between two inaccessible points involving setting of the instrument at two stations. 2 Exercises

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Total 24 Exercises
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MECHANICS OF SOLIDS

Subject Title: Mechanics of Solids
Subject Code: CE-302
Periods/Week: 04
Periods/Semester: 60

TIME SCHEDULE

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<th>S. No.</th>
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<th>No. of Periods</th>
<th>Weightage of marks</th>
<th>Short Type</th>
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<td>1.</td>
<td>Shear force and Bending Moment</td>
<td>15</td>
<td>29</td>
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<td>2.</td>
<td>Theory of simple bending</td>
<td>17</td>
<td>29</td>
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<td>Deflection of beams</td>
<td>18</td>
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OBJECTIVES

After completion of the subject, the student shall be able to:

1.0 Determine Shear Force and Bending Moment on simple Beams analytically:

1.1 Define different types of beams:
   a) Cantilever beam  
   b) Simply supported beam  
   c) Fixed beam  
   d) Continuous beam  
   e) Overhanging beam

1.2 Define different types of loads:
   a) Point Load  
   b) Uniformly Distributed Load

1.3 Describe different types of supports:
   a) Roller support  
   b) Hinged support  
   c) Fixed support

1.4 Calculate reactions at rollers/hinged and fixed supports for Simply Supported, Cantilever and Overhanging Beams
1.5 Explain terms:
   a) Shear Force
   b) Bending Moment
1.6 Deduce the relationship among the rate of loading, shear force and bending moment
1.7 Determine Shear Force and Bending Moments on Cantilever and Simply Supported Beam for simple cases of loading (Point Load, Uniformly Distributed Load) analytically
1.8 Describe the procedures for sketching the Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD)
1.9 Sketch Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD) for Cantilever and Simply Supported Beams
1.10 Define point of contraflexure
1.11 Determine the Shear Force, Bending Moment and point of contraflexure for overhanging beams
1.12 Sketch Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD) for overhanging beams

2.0 Understand the Effect of Loading on Beams:

   2.1 Define simple / pure bending
   2.2 Explain the process of simple bending
2.3 Define terms:
   a) Neutral layer
   b) Neutral axis
   c) Radius of curvature
2.4 State the assumptions made in the theory of simple bending.
2.5 Derive the bending equation for simple bending
2.6 Prove that the neutral axis passes through centroid of cross section
2.7 Define:
   a) Bending Stress
   b) Moment of Resistance
2.8 Sketch and explain bending stress distribution across the depth of the beam for any cross section
2.9 Define terms:
   a) Modulus of section
   b) Flexural rigidity
2.10 Obtain the formula for section modulus of (solid and hollow sections):
   a) Square Section
   b) Rectangular Section
   c) Circular Section
2.11 Calculate section modulus based on above formulae
2.12 Solve problems on theory of simple bending for symmetrical and unsymmetrical sections to calculate Moment of Resistance or load carried or dimensions of cross section.
2.13 State formula for calculation of Shear Stress in any layer of a cross section (Derivation of formulae not required)
2.14 Draw shear distribution across:
   a) Rectangular section
   b) Solid circular section
   c) I - section
d) **T** - section

2.15 Determine shear stress at any layer and draw shear stress distribution diagram across:
   a) Rectangular section
   b) **I** - section

2.16 Determine the maximum shear stress in circular, rectangular and square sections (Derivation of formulae not required)

### 3.0 Understand Deflection of Beams under Loading:

3.1 Draw the deflected shapes of different beams

3.2 Define:
   a) Elastic curve
   b) Slope
   c) Deflection

3.3 Distinguish between strength and stiffness of a beam.

3.4 Derive relation between slope, deflection and radius of curvature

3.5 Derive the equations for maximum slope and deflection by double integration method for:
   a) Cantilever beams with point loads and uniformly distributed loads
   b) Simply supported beams with central point load or uniformly distributed load throughout.

3.6 Calculate the maximum slope and deflection in simply supported and cantilever beams using the above formulae

3.7 Explain Mecaulay’s method (for Simply supported beams) to find the slope and deflections

3.8 Compute the maximum slope and deflection for Simply supported beam carrying point loads and uniformly distributed loads by Mecaulay’s method

3.9 Explain the moment area method for slope and deflection

3.10 Define:
   a) Mohr’s theorem-I
   b) Mohr’s theorem-II

3.11 Derive formulae for maximum slope and deflection of standard cases by moment area method

3.12 Compute the maximum slope and deflections for Cantilever and Simply Supported Beams by Mohr’s theorem-I and Mohr’s theorem-II (moment area method)

### 4.0 Understand the effects of Internal pressure on welded and riveted thin cylinders:

4.1 Define thin Cylinder

4.2 Explain failures of thin Cylinders

4.3 Explain longitudinal and hoop stresses in the cylinder under internal pressure

4.4 State the formulae for longitudinal and hoop stresses in riveted and welded thin cylinders.

4.5 Calculate the longitudinal and hoop stresses in the cylinder under internal pressure, given the dimensions of the riveted and welded thin cylinders

4.6 Calculate the thickness of a thin cylinder (riveted / welded)

4.7 State the formulae for strains and changes in dimensions of a thin cylinder

4.8 Calculate the changes in dimensions of a thin cylinder under internal pressure
5.0 Understand the effects of pure Torsion on Solid and Hollow Circular Shafts:

5.1 State pure Torsion
5.2 State the assumptions made in the pure Torsion
5.3 State the formula for pure Torsion of a circular shaft (Derivation not required)
5.4 Solve the problems on Torsion applying Torsion formula
5.5 Explain terms:
   a) Polar modulus
   b) Torsional rigidity
5.6 State the formula for power transmitted by the circular shaft
5.7 Solve the problems on power transmitted by the solid and hollow circular shafts

COURSE CONTENT

1.0 Shear force and bending Moment

b. Types of supports – Roller – Hinged – Fixed,
c. Explanation of S.F and B.M at a section
d. Relation between rate of loading SF and BM
e. Calculation of S.F. and B.M values at different sections for cantilevers Simply supported beams, overhanging beams under point loads and uniformly distributed loads, position and significance of points of contra flexure.
f. Drawing S.F. and B.M diagrams by analytical methods – location of points of contraflexure.

2.0 Stresses in Beams.

b. Shear stress in beams – Equation for shear stress in a layer of a beam (Derivation of formula not required) – Shear Stress distribution diagrams for various beam sections such as rectangular, solid circular and I sections – Problems.

3.0 Deflection of Beams

a. Deflected shapes of beams with different support conditions – Strength and stiffness of beams – Relation between curvature, slope and deflection
b. Double integration method – Derivation of standard cases – Problems
c. Macaulay’s method for slope and deflection – Simply supported beam under concentrated and uniformly distributed loads – Problems.
d. Mohr’s theorems for slope and deflection – Cantilevers and simply supported beams with symmetrical loading – Problems.
4.0 Thin Cylinders
   a) Thin cylinders – Failure of thin cylinders.
   b) Longitudinal and Hoop stresses in welded and riveted cylinders – Equations of stresses in thin cylinders (Derivation of formula not required) – Calculation of thickness in thin cylinders under internal pressures – Problems.
   c) Strains and changes in dimensions (δd, δl, δv) of thin cylinders – Problems.

5.0 Torsion
   a) Pure torsion – Assumptions – Torsion formula (Derivation not required) – Solid and hollow circular shafts subjected to pure torsion – Simple problems – Shear stress distribution in shafts.
   b) Power transmitted by circular shafts – Problems

REFERENCE BOOKS

9. Strength of Materials by R.K. Bansal
10. S.M. and T.S. by Y. Ram Mohan Rao
12. Strength of Materials by L.S. Negi

* * *
HYDRAULICS

Subject Title : HYDRAULICS
Subject Code : CE-303
Periods/Week : 05
Periods/Semester : 75

TIME SCHEDULE

<table>
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<td>Fluid pressure and its measurements</td>
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<td>Flow through orifice and mouth pieces</td>
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<td>5.</td>
<td>Flow over notches and weirs</td>
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OBJECTIVES

After completion of subject the student shall be able to

1.0 Understand the properties of Fluids
1.1 State the scope and importance of hydraulics in Civil Engineering.
1.2 Define fluid and list examples of fluids.
1.3 Differentiate ideal and real fluids.
1.4 Distinguish between fluids & liquids.
1.5 Define mass density, specific weight, specific gravity, adhesion, cohesion, surface tension, capillarity, compressibility, dynamic viscosity, kinematic viscosity and vapour pressure.
1.6 State the standard Values for mass density, specific weight, specific gravity for pure water and mercury.
1.7 State the units for the above properties.
1.8 State formulae of dynamic viscosity, capillarity surface tension of water drop and soap bubble.
1.9 Explain the practical application of surface tension.

2.0 Understand methods of measurement of liquid pressure and calculate total pressure and centre of pressure on hydraulic structures
2.1 Define atmospheric pressure, gauge pressure and absolute pressure.
2.2 States the relation between the above three pressures
2.3 Describe the various pressure measuring instruments - Piezometers, manometers - U-tube and differential manometers.
2.4 Compute the pressure of a flowing fluid given the readings on piezometers-simple, manometers-differential and inverted differential manometers.
2.5 Define Total Pressure and Centre of Pressure.
2.6 State the formulae for total pressure and centre of pressure on a horizontal, vertical or inclined plane surface immersed in a liquid at rest.
2.7 Calculate total pressure and centre of pressure for the above plane surfaces for the given conditions.
2.8 Determine total pressure and centre of pressure for hydraulic structures. (sluice gates, dams, lock gates).

3.0 Comprehend the General Principles of flow of the Liquids and Bernoulli’s theorem
3.1 State the different types of flow of liquids-
3.2 Define uniform flow, non-uniform flow, steady flow, unsteady flow, laminar and turbulent Flow.
3.3 Distinguish between different types of flow of liquids.
3.4 Define discharge and state its units.
3.5 State one dimensional continuity equation.
3.6 Compute the discharge/velocity at a section of flowing liquid in pipe for the given conditions.
3.7 State the three energies of liquid in motion-datum head, pressure head velocity head.
3.8 State Bernoulli’s theorem of total energy of a liquid in motion.
3.9 State the equation for Bernoulli’s theorem of total energy of a liquid in motion.
3.10 State the limitations of Bernoulli’s theorem.
3.11 Compute the pressure / velocity at a section of flowing liquid in pipe for the given conditions using Bernoulli’s equation.
3.12 State three practical applications of Bernoulli’s theorem ,
3.13 Describe the working principle of venturimeter, orifice meter and pitot tube.
3.14 State the formulae to calculate the actual discharge of flowing liquid through venturimeter and orifice meter.
3.15 Compute the actual discharge of flowing liquid through, venturimeter and orifice meter-numerical problems.

4.0 Comprehend the general principles of the flow of liquids through orifices and mouth pieces

4.1 Define orifice
4.2 State different types of orifices-differentiate large orifice and small orifice
4.3 Define vena- contracta, Cc, Cv, Cd (Hydraulic coefficients).
4.4 State the relation between above three coefficients.
4.5 State the formulae for actual, theoretical discharges through small orifice
4.6 Calculate the discharge, Cc, Cv ,Cd for given conditions-Numerical Problems
4.7 Derive formula for discharge through Large Rectangular Orifice.
4.8 Calculate discharge through Large Rectangular Orifice for given conditions-Numerical Problems.
4.9 State the equations for discharge through fully submerged Orifice, Partially submerged Orifice, giving the details of notations.
4.10 Compute discharge for the above two orifices for the given conditions-Numerical problems.
4.11 State the formula for time of emptying of a prismatic tank by an orifice
4.12 Compute the time of emptying of a prismatic tank by an orifice
4.13 Define mouth piece.
4.14 Differentiate mouth piece and orifice.
4.15 Write the classification of mouth pieces.
4.16 State the formulae for discharge for different types of mouth pieces.
4.17 Calculate discharge through a mouth piece for given data-Numerical Problems.

5.0 Comprehend the general principles of the flow of liquids over notches and weirs

5.1 Define a notch, state their types.
5.2 State the formulae for the discharge over rectangular, triangular and trapezoidal notches.
5.3 Calculate the discharge through the above notches from the given data - Numerical problems.
5.4 Define weir and state the types of weirs.
5.5 State the formulae for discharge over sharp crested and broad crested weirs.
5.6 State the formulae for discharge over above weirs with modifications for end contractions and velocity of approach.
5.7 Determine the discharge over sharp crested and broad crested weirs under given conditions - Numerical Problems.
5.8 Write the Francis, Bazin’s empirical formulae to determine the discharge for rectangular weir
5.9 Determine the discharge over rectangular weir using above two formulae for given data - Numerical Problems

6.0 Comprehend the General Principles of the flow of liquids through pipes
   6.1 List various losses that occur when water flow through pipes.
   6.2 Differentiate Major loss and Minor losses.
   6.3 State Chezy’s, Darcy’s formulae to compute loss of head due to friction.
   6.4 Solve numerical problems in pipes based on the above two formulae for given data - Numerical problems.
   6.5 State formulae for head loss due to various minor losses.
   6.6 Compute the above minor losses of head for given data – Numerical problems.
   6.7 Define hydraulic gradient line and total energy line.
   6.8 Calculate discharge through Parallel and Compound (series) Pipes connected to reservoir for given data - Numerical Problems.
   6.9 Define Critical velocity and Reynold’s number.
   6.10 State whether the flow is laminar or turbulent based on Reynold’s number.

7.0 Design a section of open channel flow
   7.1 Define open channel flow
   7.2 Differentiate open channel flow and pipe flow
   7.3 Define Wetted perimeter and Hydraulic mean depth/radius.
   7.4 State Chezy’s and Manning’s formula for uniform flow through open channels
   7.5 List the Values of ‘C’ for different surfaces.
   7.6 State Kutter’s, Manning’s, Bazin’s formulae to evaluate ‘C’.
   7.7 Calculate Velocity and Discharge in a channel using Chezy’s and Manning’s formulae for given conditions - Numerical problems.
   7.8 Define most economical section of a channel.
   7.9 State the conditions for most economical section of rectangular and trapezoidal channels.
   7.10 Design of rectangular and trapezoidal channel sections for the given conditions - Numerical problems.

8.0 Understand the working principles of pumps and water turbines
   8.1 Define Pump and list different types of Pumps
   8.2 Describe the parts of Reciprocating Pump with a sketch.
   8.3 Describe the working principle of single acting and double acting reciprocating pumps.
   8.4 State the functions of air vessels for reciprocating pumps.
   8.5 Describes the different parts of centrifugal pumps.
   8.6 Explain the working principle of centrifugal pump.
   8.7 Define priming and state the necessity of priming.
   8.8 State the use of foot valve and strainer in a centrifugal pump.
   8.9 Describe jet, air lift and deep well pumps and their uses.
   8.10 Define Turbine and state types of turbines.
   8.11 List the examples of Impulse and Reaction turbines.
   8.12 Differentiate between Impulse and Reaction turbines.
8.13 Explain the working principle of Pelton wheel turbine.
8.14 Describe the Parts of Francis Turbine.
8.15 State the purpose and types of draft tubes.

9.0 Understand the functions of components of Hydro-Electric Power Plants
9.1 Sketch a typical layout of hydro-electric installation.
9.2 State the different components of hydro-electric installation.
9.3 List the functions of surge tank.

COURSE CONTENT

1.0 Properties of liquids
   a) Scope and importance of hydraulics in Civil Engineering
   b) Fluids – classification - ideal and real fluids.
   c) Difference between fluids and liquids.
   d) Properties of liquids.
   e) Formulae for Dynamic viscosity, Kinematic viscosity, surface tension of water and soap bubble, capillarity.

2.0 Liquid pressure and its measurement
   (a) Atmospheric pressure, gauge pressure and absolute pressure and relationship.
   (b) Pressure measuring Instruments – Piezometer- Manometers – U-tube, inverted
       U-tube and differential manometers -Description.
   (c) Measurement of the Pressure of a flowing liquid – Piezometer - simple, differential and inverted differential manometers.
   (d) Total pressure and Centre of pressure on plane surface immersed in liquid –
       i) Horizontal ,ii) Vertical iii) inclined plane surfaces and Practical Applications.
   (e) Numerical Problems on Total pressure and Centre of pressure.

3.0 Flow of liquids
   (a) Types of Flow – Uniform flow, non-uniform flow, stream line flow, turbulent flow, steady flow and unsteady flow.
   (b) Rate of flow or discharge-continuity equation – one dimensional – Principle -
       Numerical Problems.
   (c) Energies of liquid in motion – datum head – pressure head and velocity head.
   (d) Total energy of liquid in motion – Bernoulli’s theorem (without proof) -
       limitations
       bof Bernoulli’s theorem - Numerical Problems.
   (e) Practical applications of Bernoulli’s theorem -venturi meter -orifice meter –pitot tube.
   (f) Numerical Problems on venturi meter and orifice meter.

4.0 Flow through Orifices and Mouth Pieces
   (a) Orifice-types of Orifices-difference of small and large orifice-Determination of discharge through small Orifice - Vena Contracta.-Hydraulic coefficients (Cv,Cc,Cd) – relation -(No derivation) - Numerical Problems.
(b) Large Rectangular Orifice - Derivation of formula for discharge - Numerical Problems.
(c) Flow through fully submerged and partially submerged orifices - explanation - formula for
discharge - Numerical Problems.
(d) time of emptying of a prismatic tank by an orifice - Numerical Problems.
(e) Mouth piece - Difference between Orifice and Mouth piece.
(f) Types of Mouth pieces – equations for discharge - determination of discharge through a
Mouth piece from the given details.

5.0 Flow over Notches and Weirs

Notches:
(a) Notch - types of notches - rectangular, triangular and trapezoidal notches
(b) Formulae for the discharge over rectangular, triangular and trapezoidal notches -
Numerical problems (Derivation of formulae not required)

Weirs:
(c) Weir - types of weirs – sharp crested and broad crested weirs
(d) Formulae for the discharge over a sharp crested and broad crested weirs - Numerical
problems (Derivation of formulae not required)
(e) Equations of discharge for the above weirs with velocity of approach and end
contractions.
(f) Empirical formulae for discharge over rectangular weir - Francis formula-Bazins formula-
Numerical problems (Derivation of formulae not required).

6.0 Flow thorough pipes

a) Major and minor losses.
b) Frictional loss in pipes - Chezy’s formula and Darcy’s formula (without proof) -
Numerical problems.
c) Minor Losses - Loss of head at entrance and exit of pipe, loss of head due to
sudden enlargement, sudden contraction – Formulae - simple problems.
d) Hydraulic gradient and total energy line.
e) Discharge through parallel pipes and compound pipes (series) connected to a
reservoir.
f) Laminar and turbulent flow in pipes - critical velocity and Reynold’s number –
significance (no problems).

7.0 Flow through open Channels

a) Open channel flow - differences between open channel flow and pipe flow.
b) Geometric properties of channel - Wetted perimeter and hydraulic mean depth.
c) Discharge through open channel – Chezy’s formula (derivation not necessary).=
Numerical problems
d) Value of ‘C’ for different surfaces.
e) Empirical formulae for value of C.
  1. Kutter’s formula.
  2. Manning’s formula
  3. Bazin’s formula.
f) Conditions for Most economical section of a channel - rectangular and trapezoidal
sections - Design of cross sections - problems.
8.0 Pumps and Turbines

Pumps:
  a) Pumps – types - reciprocating pumps and centrifugal pumps.
  b) Reciprocating pumps- singe acting and double acting pumps- description and working – functions of air vessels.
  c) Centrifugal pumps-description of parts – working – priming.
  d) foot valve and strainer.
  e) Other type of pumps-jet, airlift and deep well pumps – brief description - uses.

Turbines:
  a) Classification of turbines-impulse and reaction turbines.
  b) Impulse turbine -Pelton Wheel, description and working(without problems)
  c) Reaction turbines- Francis and Kaplan turbines
  d) Description and working of Francis turbine (without problems).
  e) Draft tube- purpose and types.

9.0 Hydro-electric Installation

a) Sketch a typical layout of a hydro electric power plant - components –
   Intake works, Pressure tunnel, penstock, surge tank, anchor blocks and tailrace.

b) Functions of surge tank.

REFERENCE

1. Hydraulics by Reya & Rao
3. Fluid Mechanics &Hydraulics by – Bansal.
4. Fluid Mechanics and Hydraulic Machines by Sukumar Pati

***
SURVEYING – II

Subject Title : Surveying – II
Subject Code : CE-304
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE

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<th>S. No.</th>
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OBJECTIVES

At the end of this subject, student shall be able to

1.0. **Understand the principles of levelling for different engineering purposes**

1.1. Define levelling and list the types of levelling instruments
1.2. Define the important terms in levelling
1.3. List the component parts of a dumpy level and their functions
1.4. Explain the steps involved in Temporary adjustments of a dumpy level.
1.5. List various types of levelling staves
1.6. List the Errors in levelling
1.7. Enumerate natural and instrumental errors and Precautions to prevent errors
1.8. Tabulate the levelling field data
1.9. Compute reduced levels by height of instrument and Rise and fall methods, and apply check
1.10. Compare height of instrument and Rise and fall methods
1.11. State the effect of Errors due to curvature and refraction
1.12. Compute the Error due to curvature, refraction and combined error and the correction to be applied
1.13. Explain the types of Levelling
1.14. Describe in detail profile levelling and reciprocal levelling
1.15. List the errors eliminated in reciprocal levelling
1.16. Derive the formula for true difference in elevation and true error between two points in reciprocal levelling
1.17. Calculate true difference in elevation and collimation error in reciprocal levelling
1.18. List the fundamental lines of dumpy level and state the relationship among them
1.19. Explain permanent adjustments of a dumpy level (one peg method only)
1.20. Define contour, contour interval and horizontal equivalent
1.21. List the Characteristics and uses of contours
1.22. List the methods of contouring
1.23. Describe Block contouring and radial contouring
1.24. Explain the interpolation of contours
1.25. Explain the method of tracing contour gradient / alignment of hill road

2.0. Understand the principles of theodolite surveying
2.1. List the parts of a transit theodolite and their functions
2.2. List the functions and uses of a theodolite
2.3. List the types of theodolites and differentiate between transit and non transit theodolites
2.4. Define the important terms used in theodolite survey
2.5. List the fundamental lines of a transit theodolite and their relationships.
2.6. Explain the method of temporary adjustments of a transit theodolite for taking observations.
2.7. Understand the reading of vernier and least count
2.8. Explain the measurement of horizontal angle by repetition method
2.9. Rule the page of a theodolite field book and explain the method of calculating angle by method of repetition
2.10. List the errors eliminated in repetition method
2.11. Explain the measurement of horizontal angle by reiteration method
2.12. Rule the page of a theodolite field book and explain the method of calculating angles by method of reiteration
2.13. Explain the measurement of direct and deflection angles
2.14. Explain the Steps involved in setting out angles using a theodolite.
2.15. Explain the measurement of Vertical angles
2.16. Explain measurement of magnetic bearing of a line
2.17. Explain the methods of prolonging a given survey line
2.18. Explain the method of conducting traverse survey by included angles method, deflection angles method and magnetic bearing method
2.19. Checks the angular measurements and apply corrections in a closed traverse
2.20. Define latitude and departure of a line
2.21. Compute the latitudes and departures of survey lines of a closed traverse and calculate the error of closure.
2.22. List the types of omitted measurements of a closed traverse like omission of i) Length and bearing of one side ii) Length of one side and bearing of another side iii) Length of two sides iv) Bearing of two sides
2.23. Calculate the omitted measurements when Length and bearing of one side only is omitted.
2.24. Balance the closing error by Bowdich and Transit rule.
2.25. Enumerate the difference between consecutive and independent co-ordinates
2.26. Calculate the consecutive and independent co-ordinates of stations of a closed traverse
2.27. Calculate the area of a closed Traverse by independent co-ordinates
2.28. List the types of errors in theodolite surveying.

COURSE CONTENT

1. Levelling
   a) Levelling – Types of levelling instruments – component parts of a dumpy level and their functions – Definitions of important terms used in Levelling – level surface, level line, plumb line, horizontal line, axis of telescope, line of collimation, back sight, fore sight, intermediate sight, station and change point – Temporary adjustments of a dumpy level – types of Levelling Staves
   b) Bench marks – different types of bench marks
   c) Booking of readings in field book – Determination of Reduced levels by height of instrument and Rise and Fall methods – Comparison of methods – Problems.
   d) Errors in levelling – natural and instrumental errors – Precautions
   e) Errors due to curvature and refraction and combined correction – problems
   f) Classification of Levelling – detailed description of profile levelling and reciprocal levelling – Problems on Reciprocal levelling.
   h) Fundamental lines of dumpy level and their relations – Permanant adjustments of a dumpy level (one peg method without problems)

2. Theodolite
   a) Principles of theodolite surveying
      i) Component parts of a transit theodolite and their functions – Definitions of technical Terms – Station, face left, face right, swinging the telescope, transiting.
      ii) Fundamental lines of a transit theodolite – Horizontal axis, vertical axis, axis of telescope, axis of plate levels, axis of altitude bubble, line of collimation – Conditions of adjustments.
      iv) Temporary adjustments of a transit theodolite.
      v) Measurement of horizontal angles by repetition and reiteration method
      vi) Measurement of vertical angles
      vii) Booking readings
      viii) Measurement of magnetic bearings, deflection angles, direct angles – Prolonging a straight line – by single transiting, double transiting and fore sighting methods
      ix) Errors in theodolite work.
   b) Theodolite Traversing
      i) Traversing with theodolite by included angles method, deflection angles method and magnetic bearing method.
      ii) Checks for closed and open traverse.
iii) Traverse computations – Latitude and departure – closing error – balancing a closed traverse by Bowditch rule and transit rule – omitted measurements in a closed traverse – problems on omitted measurements (Length and bearing of one side only omitted) – consecutive and independent coordinates - area of closed traverse.

REFERENCE

2. Surveying I & II by B.C.Punmia
3. Surveying by S.K. Husain
4. Surveying and levelling I & II by T.P Kanetkar
5. Surveying - I & II by A. V.R.J. Sharma and Kamala
6. Text book of surveying by Dr C.Venkat Ramaiah
CONSTRUCTION MATERIALS

Subject Title : Construction Materials
Subject Code : CE-305
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

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OBJECTIVES

After completion of the subject the student shall be able to

1.0 Understand selection of stones and their acceptability for construction work
   1.1 State the classification of rocks – Physical classification only.
   1.2 State the characteristics of good building stone.
   1.3 State the common varieties of stone used in different items of construction and their suitability for construction works – Granite, marble, Kadapa slabs, shahabad stones.
   1.4 Explain the purpose of dressing stones.

2.0 Understands the acceptability of bricks for construction work
   2.1 Common sizes of bricks – IS specifications.
   2.2 List the steps involved in the manufacture of bricks.
2.3 State the necessity of burning bricks.
2.4 Explain the method of burning bricks in a continuous kiln.
2.5 State the characteristics of good bricks.
2.6 Explain the standard tests for bricks.
2.7 Explain water absorption and compression strength tests only, done on bricks.
2.8 State the uses of different kinds of bricks for construction purposes - refractory bricks, fly ash bricks, Precast Solid Concrete Blocks, Hollow concrete blocks, High quality building blocks.

3.0 Understand suitability of tiles, pipes and building sand for construction
3.1 State the common variety of tiles used for different purposes.
3.2 State the characteristics of good tiles.
3.3 State the uses of porcelain and glazed tiles.
3.4 State the uses of stone ware pipes.
3.5 State the characteristics of good sand.
3.6 State the functions of building sand.
3.7 State the percentage of bulk age allowance for construction work.
3.8 State the necessity of quarry dust as a substitute of sand.

4.0 To check the quality of cement for construction work
4.1 State the chemical composition of cement.
4.2 State rough and ready methods of examining cement.
4.3 Explain the method of manufacture of cement by dry process only.
4.4 State the classification of cements and their uses.
4.5 State the standard tests for cement.
4.6 Explain tests on cement for fineness, consistency, setting times and soundness of cement.
4.7 State grades of cement and their compressive strengths.
4.8 State the importance of blended cement.
4.9 Explain the application of blended cement with fly ash and blast furnace slag.

5.0 Understands the principles of preparation of mortars and Concrete
5.1 Explain the term fine aggregate, coarse aggregate.
5.2 Explain the purpose of water absorption and sieve analysis tests conducted on fine and coarse aggregate. (Procedure of tests not necessary).
5.3 State the classification of mortars.
5.4 State the different proportion of mortars for various works.
5.5 Explain the method of preparation of cement mortar – use of super plasticiser for improving workability and higher strength.
5.6 State the ingredients of plain and reinforced concrete.
5.7 State the usual proportions of plain and reinforced concrete for different items of work.
5.8 Define i) Hydration of cement ii) water cement ratio.
5.9 Explain the importance of Hydration of cement, water cement ratio.
5.10 Explain the method of preparing concrete.
5.11 State the steps involved in the procedure of mixing, conveyance, placing, and compaction and curing of concrete.
5.12 State the need of curing.
5.13 List the methods of curing suitable for different surfaces.
5.14 Define workability.
5.15 Explain the method of slump test to know the workability, compressive strength test to know the strength of concrete.
5.16 State the types and uses of admixtures in concrete.
5.17 Explain about ready mix concrete.
5.18 State the advantages and disadvantages of ready mix concrete.
5.19 State the use of fly ash, quarry dust for improved durability and better resistance to adverse exposure conditions.

6.0 Understand the selections and applications of Surface Protective Materials
6.1 State the composition of Paints, enamels, varnishes.
6.2 List the types and uses of surface protective materials like Paints, Enamels, Varnishes, Distempers, Emulsion, French polish and Wax Polish.

7.0 Understands the selections and applications of Wood, Plastics, Glass and Asbestos for construction work
7.1 State the characteristics of good timber.
7.2 State the importance of seasoning.
7.3 Name the common varieties of timber used in A.P for various Civil Engineering work.
7.4 State various types of wood products used in construction work.
7.5 State the uses of wood products used in construction work.
7.6 List the uses of uses of fibre reinforced plastic.
7.7 State merits and demerits of plastics.
7.8 State the merits and demerits of asbestos products.
7.9 State suitability of different types of glasses as a building material.
7.10 State the merits and demerits of glass.
7.11 State suitability of Powder coated Aluminium and Steel sheets as building material.

COURSE CONTENT

1) Stones
   a) Classification of rocks, physical classification.
   b) Characteristics of good building stone.
   c) Common varieties of stones-granite, marble, Kadapa slab, Shahabad stones.
   d) Dressing of stones – purpose.

2) Bricks
   a) Method of manufacture of bricks – continuous kiln process
   b) ISI specification for bricks IS-1077-1971.
   c) Characteristics of good bricks.
   d) Testing of bricks as per IS-3495-1966 – tests on water absorption and compressive strength of bricks.
   e) Refractory bricks and their uses.
   f) Fly ash bricks.

3) Clay products & Sand
   a) Tiles –Types of tiles roofing tiles (Mangalore tiles), floor tiles,
Ceramic tiles, Vitrified tiles, Morbonite.
b) Characteristics of good tiles.
c) Porcelain – glazed tiles (uses only).
d) Stone ware pipes – uses.
e) Characteristics of good sand, Functions of sand.
f) Bulking of sand – percentage of bulking – bulk age allowance to be permitted.
g) Crushed stone powder as substitute of sand.

4) Cement
a) Chemical composition of cement.
b) Rough and ready method of testing cement.
c) Methods of manufacture of cement – Dry process.
e) Tests for cement as per ISI – fineness, consistency, setting time, soundness tests.
f) Blended cement.

5) Mortars & Concrete
a) Fine aggregate and course aggregate – Water absorption and sieve analysis of fine and coarse aggregates.
b) Mortar – Classification of mortar – Lime mortar, cement mortar, Surkhi Mortar, Blended mortar.
c) Different proportions of mortars for various works.
d) Preparation of cement mortar.
e) Ingredients of plain concrete.
f) Proportioning – usual proportions for different item of work. Foundation, Footings, Columns, Slabs & Beams for ordinary buildings.
g) Plain concrete and reinforced concrete.
h) Water cement ratio – factors effecting water cement ratio.
l) Procedure of mixing, conveyance, placing compaction, and curing of concrete.
m) Curing – methods – suitability
n) Introduction to ready mix concrete – Advantages and disadvantages.
o) Use of fly ash, quarry dust.

6) Surface Protective Materials
a) Composition of Paints, enamels, varnishes.
b) Types and uses of surface protective materials like Paints, Enamels, Varnishes, Distempers, Emulsion, French polish and Wax Polish.
7) **Timber, Plastics, Glass and Asbestos**
   a) Characteristics of good timber.
   b) Seasoning of timber – Importance.
   c) Common varieties of timber used for different items of work – Doors and windows, form work, centring with particular references of A.P.
   e) Types of plastics – fibre reinforced plastics for plastic doors and windows and water tanks.
   f) Use of asbestos – manufacture of asbestos sheets and pipes.
   g) Types of glasses and uses.

**REFERENCE**

1. Construction Technology by Sarkar Oxford University Press
3. Building materials & components by C B R I
4. Building materials by Kulakarni
5. Construction materials by N. Sreenivasulu
6. Building Materials by Duggal S. K.
CONSTRUCTION PRACTICE

Subject Title : Construction Practice
Subject Code : CE-306
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
<th>Weightage of marks</th>
<th>Short Type</th>
<th>Essay Type</th>
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<tbody>
<tr>
<td>1.</td>
<td>Classification of buildings and Foundations</td>
<td>12</td>
<td>26</td>
<td>02</td>
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<tr>
<td>2.</td>
<td>Masonry</td>
<td>07</td>
<td>13</td>
<td>01</td>
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<td>3.</td>
<td>Doors, Windows and Lintels, Sunshades</td>
<td>07</td>
<td>13</td>
<td>01</td>
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<tr>
<td>4.</td>
<td>Roofs and Floorings</td>
<td>11</td>
<td>16</td>
<td>02</td>
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<tr>
<td>5.</td>
<td>Scaffolding and Stair Cases</td>
<td>07</td>
<td>13</td>
<td>01</td>
<td>01</td>
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<tr>
<td>6.</td>
<td>Protective, decorative finishes and Termite proofing</td>
<td>08</td>
<td>16</td>
<td>02</td>
<td>01</td>
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<tr>
<td>7.</td>
<td>Energy management and Energy audit of building</td>
<td>05</td>
<td>10</td>
<td>-</td>
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<td>8.</td>
<td>Solar energy utilization in buildings</td>
<td>03</td>
<td>03</td>
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<td>Total</td>
<td>60</td>
<td>110</td>
<td>10</td>
<td>08</td>
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</table>

OBJECTIVES

After completion of subject the student shall be able to

1.0 Knows the classification of Buildings and design of foundations as per NBC
1.1 State the components of a building and their functions.
1.2 State the classification of buildings with according to National Building Code with examples.
1.3 Explain the investigations required for foundation as per N.B.C.
1.4 Describe with line diagrams – spread footings, raft, pile and well foundation.
1.5 Explain the term bearing capacity of soil, safe and ultimate bearing capacity of soil.
1.6 State the loads to be considered in design of foundation.
1.7 State rules for minimum depth, width of foundation and thickness of concrete bed for spread footing foundation.
1.8 Explain the method of constructing spread footing foundation.
1.9 List the causes and effect of dampness at basement level.
1.10 List the measurements for prevention of dampness at basement level.

2.0 Understand the construction of masonry work
2.1 List different types of stone masonry.
2.2 Explain the different types of stone masonry.
2.3 State the general principles to be observed in stone masonry construction
2.4 Explain the term bond, course, headers, and stretcher relating to brick masonry.
2.5 State general principles of brick masonry.
2.6 Explain with sketches, English bond for alternate layers brick masonry of various wall thicknesses.
2.7 Explain with sketches masonry with Precast concrete solid blocks, Hollow blocks, high quality building blocks maintaining bond.

3.0 Understand the types and principles of doors, windows, ventilators, Lintels and sunshades.
3.1 State the principles of locating doors, windows and ventilators in buildings.
3.2 Explain with sketches common and special types of doors, windows and ventilators.
3.3 List the uses of different types of doors, windows and ventilators.
3.4 Explain the fittings and fastenings of doors, windows and ventilators.
3.5 Explain the functions and types of lintels.
3.6 Explain the functions of sunshades, canopy, sun-breakers and porticos.
3.7 Explain about thin lintel developed by CBRI with simple sketches.

4.0 Understand methods of construction and finishes of different types of roofs and floorings.
4.1 State the functions of roofs.
4.2 State the classification of roofs.
4.3 State the classification of trusses based on material and shape.
4.4 Explain with sketches king post truss, queen post truss, fan roof truss, north light roof trusses.
4.5 Explain with sketches A type, B type steel trusses using structural angles and tubular sections as per the provisions of IS code.
4.6 State the common and decorative ceilings used in construction work.
4.7 Explain the method of fixing Plaster of Paris and fibre glass ceilings.
4.8 State the component parts of flooring.
4.9 State the functions of flooring.
4.10 List the requirements of good floor.
4.11 Explain method of construction of C.C flooring, stone slab flooring, tiled flooring, mosaic flooring, Ceramic flooring, and Marble flooring.

5.0 Understand scaffolding and types of Stair cases.
5.1 State the purpose of scaffolding.
5.2 Define scaffolding and mention the types.
5.3 List the component parts of tubular scaffolding.
5.4 Sketch and explain about tubular scaffolding.
5.5 State the advantages of tubular scaffolding.
5.6 State the principles of locating stairs.
5.7 Explain terms: rise, tread, landing, flight, going, hand rail, newal post, baluster and balustrade.
5.8 Draw the line diagrams of different stairs.

6.0 Understand Protective, decorative finishes and Termite Proofing
6.1 State the objects of plastering.
6.2 State the methods of plastering.
6.3 State the steps in providing cement plastering on masonry walls.
6.4 State the use of wall putty as a decorative finish on masonry walls.
6.5 State the objects of pointing.
6.6 State the types of pointing.
6.7 State the objects of painting.
6.8 Explain the method of painting new and old walls surfaces.
6.9 State the paints suitable for painting wood work and steel work.
6.10 Explain briefly the method of white washing, colour washing, distempering the brick masonry wall.
6.11 Define termite proofing.
6.12 Explain the method of termite proofing.

7.0 Appreciate the concept of energy management and energy audit of buildings
7.1 Explain the possible ways of energy management in buildings.
7.2 State the aims of energy management of buildings.
7.3 Distinguish among energy auditing schemes.
7.4 State the response to audit questionnaire.
7.5 Explain energy surveying and audit report.
7.6 Formulate the energy flow charts.

8.0 Understand the concept of solar energy utilization in buildings
8.1 Explain the passive concepts in heating and cooling.
8.2 List the various solar energy utilities like solar water heaters, solar air heaters, solar cookers and solar PV panels.

COURSE CONTENT

1) Classification of Buildings and foundations
   a) Component parts of a building – Their functions.
   b) Classification of buildings according to National building code.
c) Site investigation for foundation as per N.B.C, Trial pit, auger boring.
d) Bearing capacity of soils – safe and ultimate bearing capacity.
e) Spread footing foundation for columns and walls.
f) Raft foundation.
g) Pile foundation – RCC Piles – Bearing piles, friction piles and under reamed pile.
h) Well foundation – component parts – sinking of well foundation.
i) Different loads to be considered for the design of foundation as per IS 875 – 1987.
k) Construction of foundation – (spread footing foundation only).
l) Causes, effects and prevention of dampness at basement level.

2) Masonry
a) Classification of stone masonry – Ashlar, Random rubble and Coursed Rubble Masonry – general principles to be observed while constructing stone masonry
b) Brick Masonry – Bonds in brick masonry – (English bond only) for various wall thicknesses – General principles to be observed in construction of brick masonry.

3) Doors, Windows, Lintels and Sunshades
a) Doors and windows – parts of door window – positioning.
b) Common types of doors- panelled, Glazed and Flush doors.
c) Special types of doors – Flush doors with modern construction materials, revolving doors, collapsible doors, rolling shutters, sliding doors, referring to A.P.D.S.S for size of doors and windows.
e) Ventilators – fixed, swinging type and louvered.
f) Fittings and fastenings for doors and windows.
g) Lintels – Functions – Types of lintels – R.C.C., wood, stone and steel.
h) Sunshade, canopy and sun breakers – lintel cum sunshade.

4) Roofs and Floorings
a) Roof – functions of roofs.
b) Classification of roofs – flat roofs – pitched roofs.
c) Different types of trusses – classification based on material and shape king – post truss, queen post truss, fan roof truss, north light roof truss, steel trusses of A type and B type using angular and tubular sections as per IS code.
d) Weather proof course on R.C.C. roof.
f) Parts of flooring – Requirements of a good floor.
g) Methods of constructing flooring – cement concrete flooring, stone slab (Kadapa slab, Shahabad stone) floorings, cement plaster flooring, Tiled flooring, mosaic flooring.

5) Scaffolding, Stairs and staircases
a) Scaffolding – Purpose and types – tubular scaffolding only.
b) Location of stairs.
c) Types of different stairs – straight, Quarter turn, half turn, Dog legged, open well, bifurcated, spiral/helical stair case, free standing and slab less stairs/staircase.

6) Protective, decorative finishes and Termite proofing
   external finishing – sand faced, pebble dash, acoustic plastering and marble chips – Internal finishing – wall paper and wall putty finishing.
b) Pointing – purpose –Types of pointing
d) White washing – colour washing – Distempering – internal and external walls.
e) Termite proofing – method.

7) Energy Management and Energy Audit of Buildings
a) Introduction to Energy Management and Energy Audit of Buildings
b) Aims of energy management of buildings
c) Types of energy audit
d) Energy audit questionnaire
e) Response
f) Energy surveying and audit report
g) Energy flow charts

8) Solar Energy Utilization in Building
a) Passive concepts – Heating and cooling concepts
b) Solar energy utilities – Solar water heaters, solar air heaters, solar cookers and solar PV panels.

REFERENCE

1. National Building code by N.B.C
3. Building Construction by Sushil Kumar
5. SP20 Explanatory handbook on Masonry code
6. Design of foundation structures principles and practice by Nainan P. Kurian
CIVIL ENGINEERING DRAWING-I

Subject Title : Civil Engineering Drawing - I
Subject Code  : CE-307
Periods/Week  : 06
Periods/Semester : 90

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
<th>Weightage of marks</th>
<th>Short Type</th>
<th>Essay Type</th>
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<td>Introduction</td>
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<td>Residential Buildings</td>
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<td>Public and Industrial Buildings</td>
<td>21</td>
<td>28</td>
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<td>4.</td>
<td>Working drawings</td>
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Note: All questions are to be answered. Part-A 5X4=20 marks & Part-B 2X20=40 marks

OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Apply standard practices in drawing different components of building
   1.1 Sketch the conventional signs of various Civil Engineering materials, plumbing and electrical fixtures.
1.2 Draw the cross section of load bearing wall and name all components below and above ground level.

1.3 Draw the plan of one Brick wall meeting at corner showing alternative courses of header and stretchers in English bond.

1.4 Draw the elevation and sectional plan of fully panelled door and label the parts.

1.5 Draw the elevation and sectional plan of fully panelled window and glazed window and label the parts.

1.6 Draw the elevation of king post and Queen post trusses and label the parts with the given data (details of joints not required)

2.0 Understand the requirements of setbacks and orientation principles for planning residential buildings as per local bye laws and NBC (National Building Code)

2.1 Draw the site plan of a residential building as per local bye-laws.

2.2 Draw the plan, section and elevation of single storied load bearing type residential building from the given line diagram and set of specifications. A) one room with veranda B) one bedroom house C) two bedroom house

2.3 Draw the plan, section and elevations of single storied framed structure type residential building from the given line diagram and set of specifications. A) one bedroom house B) two bedroom house

2.4 Draw plan and section of a dog legged stair with given specifications.

2.5 Draw the plan of first and second floors, section and elevation of two-storied residential building (framed structure) from the given the line diagram and set of specifications.

2.6 Prepare the drawings in the standard format for obtaining sanction from a local body for a residential building (Two storeyed, two bedroom building) including a rain water harvesting structure

3.0 Draw the line diagram (to a scale) of public and Industrial buildings

3.1 Rural hospital of 10 beds capacity

3.2 Hostel for 50 students

3.3 Primary school of 250 to 300 students

3.4 Apartments - plan of one floor with 6 to 10 units @ 90 –150 sq.m/unit

4.0 Working drawings

4.1 Prepare a working drawing for the purpose of marking the width of foundation for the given plan of a building

4.2 Calculate the plinth area, carpet area and floor area ratio/ floor spaces index for the given plan of a building.

COURSE CONTENT

1.0 Introduction

1.1 Conventional signs for materials like bricks, stone, concrete, wood, glass, earth, steel and electrical fixtures like ceiling fan, bulb, main switch, refrigerator, bell push, buzzer, A.C motor, and water supply and
sanitary fixtures like tap, wash basin, sink, W.C pan (Indian and European type), shower, flush tank.

1.2 Cross section of a load bearing wall showing all the components below and above the ground level.

1.3 Plan of one brick wall meeting at a corner showing odd and even courses in English bond,

1.4 Plan and Cross section of a Fully panelled door

1.5 Plan and Cross section of a Fully panelled window and glazed window showing all the component parts

1.6 Elevation of King post and Queen post trusses with the given data(details of joints not required)

2.0 Residential Buildings

2.1 Set backs and orientation principles for planning residential buildings as per local bye laws and NBC

2.2 Single storied two bed room load bearing residential building

2.3 Single storied framed structure two bedroom residential building

2.4 Two-storied residential building (framed structure type)

2.5 Dog legged stair

2.6 The standard format for obtaining sanction from local body for a residential building (up to two bedroom building–G+1 floors) including a rainwater harvesting structure.

3.0 Public and industrial buildings

Draw the line diagrams only showing the functional requirements of

3.1 Rural hospital of 10 beds capacity

3.2 Hostel for 50 students

3.3 Primary school of 250 to 300 students

3.4 Apartments - plan of one floor with 6 to 10 units @90 – 150 sq.m / unit

4.0 Working drawings

4.1 Working drawing for the purpose of marking from the given plan and width of foundation.

REFERENCE

1. Civil Engineering Drawing-I by Chakraborty

2. Civil Engineering Drawing-I by N.Srinivasulu.
SURVEYING –II Practice

Subject Title : SURVEYING –II Practice
Subject Code : CE-308
Periods/Week : 06
Periods/Semester : 90

TIME SCHEDULE

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<tr>
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<tr>
<td>1.</td>
<td>Levelling</td>
<td>36</td>
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<tr>
<td>2.</td>
<td>Theodolite Survey</td>
<td>24</td>
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<tr>
<td>3.</td>
<td>Plotting</td>
<td>30</td>
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</table>

Total 90

OBJECTIVES

At the end this course the student shall be able to

1.0 Perform different methods of levelling
1.1 Identify the component parts of a dumpy level / Auto level
1.2 Study different types of levelling staves
1.3 Perform temporary adjustments of a dumpy level / Auto level for taking observations
1.4 Practice taking staff readings and recording them in level field book
1.5 Take staff readings for differential levelling and compute the difference in elevation between two stations (take invert levels also)
1.6 Conduct fly levelling and determine RLs of required stations
1.7 Determine the true difference in elevation between two far off stations by conducting reciprocal levelling
1.8 Determine the collimation error of a dumpy level by conducting reciprocal levelling
1.9 Conduct profile levelling along a route and compute the RLs at various stations
1.10 Conduct profile levelling by taking cross sections across a route and compute the RLs at various stations
1.11 Conduct profile levelling along a route by taking readings along both LS and CS and compute the RLs
1.12 Conduct block levelling for the given area
1.13 Locate the contour Points by direct (Radial) method in the field

2.0 Perform Theodolite Surveying
2.1 Identify the component parts of a theodolite
2.2 Perform temporary adjustment of theodolite.
2.3 Measure horizontal angles
2.4 Record the observations in the field book.
2.5 Measure horizontal angle by repetition method
2.6 Measure horizontal angles by reiteration method
2.7 Measure Vertical angles
2.8 Prolong a given survey line by double transiting method
2.9 Measure the horizontal distance between two inaccessible points using theodolite
2.10 Measure bearing of a survey line
2.11 Conduct theodolite traversing (closed), compute latitudes and departures and calculate the area of traverse

3.0 Plotting
3.1 Plot the LS and CS along a route from the data of profile levelling, mark the formation level by selecting suitable gradient, calculate the depth of cutting and filling
3.2 Prepare the Contour map from block levelling by interpolation
3.3 Measure the horizontal distance between two inaccessible points by plotting the data observed in theodolite survey
3.4 Plot the closed traverse of theodolite, distribute the closing error by Bowditch / transit rule and calculate the area of traverse

<table>
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<tr>
<th>S.No</th>
<th>Experiment Title</th>
<th>Key Competency</th>
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<tr>
<td>1</td>
<td>Study of dumpy level / Auto level</td>
<td>Holding the instrument and fixing on tripod</td>
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<td>Identifying parts and their functions</td>
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<td>2</td>
<td>Study of levelling staves</td>
<td>Folding and unfolding operations,</td>
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<tr>
<td>3</td>
<td>Temporary adjustments of dumpy level</td>
<td>Observing reading to the accuracy of 5 mm, Holding Levelling staff to the plumb while taking observation</td>
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<tr>
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<td>Spreading the tripod on ground properly for easy levelling and stability Operation of foot screws Eyepiece adjustment Focussing the object glass</td>
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<tr>
<td>4</td>
<td>Recording observations on level field book</td>
<td>Entering Back Sight, Fore Sight and Intermediate Sight in appropriate positions Applying the methods of calculating reducing levels by Height of instrument method and Rise and fall method Finding RL when staff is inverted Applying arithmetic check</td>
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<tr>
<td>5</td>
<td>Differential Levelling &amp; Fly Levelling</td>
<td>Taking observations Locating proper position of change point to avoid cumulative errors</td>
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<td>6</td>
<td>Reciprocal Levelling</td>
<td>Taking observations</td>
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<tr>
<td>7</td>
<td>Profile levelling</td>
<td>Spreading chain along the required route Taking readings at intervals along the route and cross sections</td>
</tr>
<tr>
<td>8</td>
<td>Block Levelling</td>
<td>Dividing area into small square blocks using chains Taking readings at corners of each square</td>
</tr>
<tr>
<td>9</td>
<td>Locate the contour Points by direct method in the field</td>
<td>Positioning the staff along the radial line to get the pre-calculated staff reading for a particular RL of a contour Measuring the distances of the located points Measuring the bearings of all radial lines</td>
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<tr>
<td>10</td>
<td>Study of transit Theodolite</td>
<td>Holding the instrument and fixing on tripod Identifying parts and their functions Conducting operations like swinging and transiting</td>
</tr>
<tr>
<td>11</td>
<td>Temporary adjustments</td>
<td>Spreading the tripod on ground properly for easy levelling and stability Centring the instrument exactly over station using plumbob and by moving legs Operating foot screws to level Eyepiece adjustment Focussing the object glass</td>
</tr>
<tr>
<td>12</td>
<td>Measurement of horizontal angle by Repetition method Reiteration method and Measurement of bearing</td>
<td>Operating lower and upper clamps and their tangent screws reading the vernier accurately Recording the observations at their appropriate positions on page of theodolite field book</td>
</tr>
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</table>
| 13 | Measurement of Vertical angles | Operating vertical circle clamp and its tangent screw  
Recording the observations at their appropriate positions on page of theodolite field book |
| 15 | Measurement of horizontal distance between two inaccessible points | Measurement of horizontal angles and horizontal distances |
| 16 | Closed traverse | Measurement of bearing of one line  
Measurement of horizontal angles and horizontal distances |

**COURSE CONTENT**

1. **Levelling**
   a) Study of dumpy level, levelling staves – performing Temporary adjustments of level.
   b) Taking staff readings of various stations – booking of readings in level field book.
   c) Differential and Fly levelling – calculation of reducing levels by height of collimation and Rise & Fall methods (inverted levels also)
   d) Reciprocal levelling – True difference in elevation and collimation error.
   e) Contouring – block levelling and locating contour points by Radial method

2.0 **Theodolite surveying**
   a) Study of transit Theodolite- Temporary adjustments of a transit theodolite.
   b) Measurement of horizontal angles by repetition and reiteration methods - Recording the observations in field book
   c) Measurement of vertical angles – Recording the observations in field book
   d) Prolong a given survey line by double transiting method
   e) Determination of horizontal distance between two inaccessible points.
   f) Theodolite Traversing by included angles method

3.0 **Plotting**
   a) Plotting the LS and CS of a route from the data of profile levelling, marking the formation level by selecting suitable gradient, calculate the depth of cutting and filling
   b) Preparation of contour maps from block levelling
   c) Measurement of horizontal distance between two inaccessible points by plotting the data observed in theodolite survey
   d) Plot the closed traverse of theodolite, distributing the closing error by bowditch / transit rule and calculate the area of traverse
MATERIAL TESTING PRACTICE

Subject Title : MATERIAL TESTING PRACTICE
Subject Code : CE-309
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Topics</th>
<th>No. of periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tests on bricks</td>
<td>05</td>
</tr>
<tr>
<td>2</td>
<td>Tests on Cement</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Tests on Aggregates</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Tests on metals</td>
<td>15</td>
</tr>
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<td>Total</td>
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</table>

OBJECTIVES

1.0 Understand the standard tests on bricks to find their suitability in construction

Water absorption test on bricks

1.1 State the significance of water absorption test on bricks
1.2 State the standards on water absorption of bricks used for various construction works
1.3 Explain the procedure for conducting water absorption test on bricks
1.4 Perform water absorption test on bricks

**Crushing Strength test on bricks**
1.5 State the significance of crushing strength test on bricks
1.6 State the standards on crushing strength of bricks used for various construction works
1.7 Explain the procedure for conducting crushing strength test on bricks
1.8 Perform crushing strength test on bricks
1.9 Compare observations of crushing tests conducted on different types of bricks like clay bricks, fly ash bricks, concrete blocks

2.0 **Determine suitability of cement for given conditions of workability and strength**

**Fineness Test on cement**
2.1 State the significance of workability and Compression tests in field.
2.2 State the method of preparing sample and the number of samples required for given work.
2.3 Use apparatus required for conducting fineness test on cement
2.4 State the standards on fineness of cement
2.5 Explain the procedure for conducting the fineness test on cement
2.6 Conduct the fineness test on cement and record the observation

**Normal Consistency Test on Cement**
2.7 State the significance of normal consistency of cement
2.8 Use apparatus required for conducting normal consistency test on cement sample
2.9 Explain the procedure for conducting normal consistency test on cement sample
2.10 Perform the normal consistency test on cement sample
2.11 Draw the inference from the observations of normal consistency of fresh cement and old cement samples of same and different grades

**Setting Time Test on cement**
2.12 State the significance of setting times on construction activity
2.13 State the standards on initial and final settings times of various types of cements
2.14 Use apparatus required for conducting initial and final setting times of given cement sample
2.15 Explain the procedure for conducting initial and final setting times of given cement sample
2.16 Perform the initial time test on cement sample
2.17 Draw the inference from the observations of initial setting times of fresh and old cement samples of same and different grades

**Compressive Strength of cement**
2.18 State the significance of compressive strength of cement used for various civil engineering works
2.19 State various grades of cement available in the market based on compressive strength of the cement
2.20 State the standards on compressive strengths of different types of cements used in construction
2.21 Use apparatus required for conducting compressive strength test on given cement sample
2.22 Explain the procedure for conducting compressive strength test on given cement sample
2.23 Perform the compressive strength test on given cement sample
2.24 Draw the inference by comparing the observations of compressive strength test on fresh and old cement samples

3.0 Determine suitability of different aggregate used for various civil engineering works

**Water absorption test on sand**

3.1 Study the significance of water absorption of sand used for construction
3.2 State standards on water absorption of sand
3.3 Use apparatus required for conducting water absorption test on given sand sample
3.4 Explain the procedure for conducting water absorption test on given sand sample
3.5 Perform water absorption test on given sand sample

**Test on Bulking of sand**

3.6 Study the effect of bulking of sand on quantities of material and quality of mortar and concrete
3.7 Study the significance of bulking of sand on strength and durability properties of mortar and concrete
3.8 Use apparatus required for conducting bulking of sand test on given sand sample
3.9 Explain the procedure for conducting bulking of sand test on given sand sample
3.10 Draw the inferences from the observations of bulking of sand tests conducted fine, medium and coarse sands
3.11 Study the field method of adjustment for bulking of fine aggregate

**Test on determination of bulk density and percentage of voids in Coarse and Fine aggregate**

3.12 Use apparatus required for conducting test to determine bulk density of coarse and fine aggregate
3.13 Perform tests to determine bulk density of coarse and fine aggregate
3.14 Study the effect of voids in coarse and fine aggregates on strength and durability properties of mortar and concrete
3.15 Use apparatus required for conducting tests to find percentage of voids present in aggregate
3.16 Perform tests to determine percentage of voids present in aggregate

Sieve analysis of coarse and fine aggregates
3.17 Study the significance sieve analysis of fine and coarse aggregates on properties of concrete
3.18 Study of grading limits of fine aggregate as per IS: 383-1970
3.19 Use apparatus required for conducting sieve analysis of fine aggregate

Field method to determine fine silt in aggregate
3.20 Study of effect of silt in aggregate on properties of cement mortar and concrete
3.21 Use apparatus required for determining the silt content in aggregate
3.22 Explain the field method to determine quantity of silt content in aggregate
3.23 Perform the test to determine the content of fine silt in aggregate

4.0 Understand the standard tests on metals

Tension test on mild steel rod
4.1 Study the properties of mild steel used as reinforcement in concrete
4.2 State the standards on reinforcement steel as per IS Code
4.3 State various tests conducted on mild steel by using UTM
4.4 Explain the tension test on Mild steel specimen
4.5 Perform tension test on mild steel using UTM
4.6 Study the behaviour of the steel with increasing load
4.7 Draw inferences from tests on different grades of steel

Torsion test on mild steel rod
4.7 Study the significance of torsion test on mild steel
4.8 Explain the torsion test on mild steel specimen
4.9 Perform torsion test on mild steel

Hardness test on metals
4.10 Study the significance of hardness of metals
4.11 Explain the hardness test by Brinell/Rockwel testing machine
4.12 Perform hardness test on given steel and brass samples
4.13 Study hardness of different metals with variation surface smoothness of metals

Izod/Charpy Impact test on metals
4.14 Study of effect of impact loading over structures made of different metals
4.15 Explain method of Izod/Charpy impact test on Mild steel and brass specimen
4.16 Perform Impact test on Mild steel and brass specimens by sing Izod/Charpy Testing machine

Deflection test on beam
4.17 Use apparatus required for conducting deflection tests on steel and wooden beams
4.18 Perform deflection test on steel and wooden beams at different positions of loading
**Deflection test on helical springs**

4.19 State different types of springs used for different engineering purposes

4.20 State apparatus used for conducting deflection test on closely coiled helical spring

**KEY Competencies to be achieved by the student**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Experiment Title</th>
<th>Key Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Absorption on bricks</td>
<td>Taking weight of dry bricks and wet bricks</td>
</tr>
</tbody>
</table>
| 2     | Crushing strength test on bricks                               | 1. Preparation of 1:1 cement mortar and application cement mortar over top and bottom faces of brick  
|       |                                                                 | 2. Application of load gradually at the rate 14 N/mm² per minute till failure a occurs  
<p>|       |                                                                 | 3. Recording the load at FAILURE                                                |
| 3     | Fineness test on cement                                        | Taking weight of cement sample and its residue                                  |
| 4     | Normal consistency test on cement                             | 1. Measurement of required percentage of water to cement accurately              |
|       |                                                                 | 2. Preparation of sample in the mould                                            |
|       |                                                                 | 3. Reading of Vicat’s scale/noting down the plunger penetration                  |
| 5     | Setting times of cement                                        | 1. Measurement of required percentage of water to cement accurately              |
|       |                                                                 | 2. Preparation of sample in the mould                                            |
|       |                                                                 | 3. Reading of Vicat’s scale/noting down the needle penetration                   |
|       |                                                                 | 4. Recording time at required needle penetration                                 |
| 6     | Compressive strength test on cement                           | 1. Taking weights of different grades of standard sand and cement accurately     |
|       |                                                                 | 2. Addition of required percentage of water to cement accurately                 |
|       |                                                                 | 3. Application of load at required rate and recording of load at failure accurately |
| 7     | Water absorption of sand                                       | Accurate weighing of dry sand and wet sand                                       |
| 8     | Bulking of sand                                                | 1. Measuring of sand and water accurately                                       |
|       |                                                                 | 2. Addition of water to sand in accurate increments                            |
|       |                                                                 | 3. Measuring of increasing in volume of sand                                    |
| 9     | Determination of necessary adjustment for bulking of fine aggregate by field method | Measurement of volume of sand accurately                                        |</p>
<table>
<thead>
<tr>
<th>10</th>
<th>Bulk density and Percentage of voids in coarse and fine aggregates</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1. Taking of weight of cylindrical metal measure accurately</td>
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<tr>
<td></td>
<td>2. Calculating of bulk density of coarse and fine aggregates both in loose and compacted states</td>
</tr>
<tr>
<td></td>
<td>3. Taking weight of aggregate and containers</td>
</tr>
<tr>
<td>11</td>
<td>Sieve analysis of coarse and fine aggregate</td>
</tr>
<tr>
<td></td>
<td>1. Correct arrangement of sieves used for the sieve analysis of fine or coarse aggregate</td>
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<td>2. Weighing of residue in each sieve accurately</td>
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<tr>
<td>12</td>
<td>Field method of determining fine silt in aggregate</td>
</tr>
<tr>
<td></td>
<td>1. Measuring sand by graduated cylinder accurately</td>
</tr>
<tr>
<td></td>
<td>2. Measuring correct quantity of water to be added to sand</td>
</tr>
<tr>
<td>13</td>
<td>Tension test on mild steel rod</td>
</tr>
<tr>
<td></td>
<td>1. Marking of gauge length on the MS Rod</td>
</tr>
<tr>
<td></td>
<td>2. Fixing the specimen correctly in between jaws</td>
</tr>
<tr>
<td></td>
<td>3. Application of load at required rate carefully</td>
</tr>
<tr>
<td></td>
<td>4. Measuring the load at failure accurately</td>
</tr>
<tr>
<td>14</td>
<td>Torsion test on mild steel rod</td>
</tr>
<tr>
<td></td>
<td>1. Measurement of length and diameter of specimen accurately</td>
</tr>
<tr>
<td></td>
<td>2. Application of load accurately</td>
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<tr>
<td></td>
<td>3. Measuring the angle of rotation accurately</td>
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<tr>
<td>15</td>
<td>Brinell/Rockwell</td>
</tr>
<tr>
<td></td>
<td>1. Placing of specimen at exact position</td>
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<tr>
<td></td>
<td>2. Application and release of load at required rate</td>
</tr>
<tr>
<td>16</td>
<td>Izod/Charpy test on mild steel/brass</td>
</tr>
<tr>
<td></td>
<td>1. Preparation of standard specimen and fixing the specimen in the right position of anvil</td>
</tr>
<tr>
<td></td>
<td>2. Recording down the reading by observing the appropriate scale</td>
</tr>
<tr>
<td>17</td>
<td>Deflection test on beams</td>
</tr>
<tr>
<td></td>
<td>1. Measuring the dimensions of specimen accurately</td>
</tr>
<tr>
<td></td>
<td>2. Application of load at exact point of application</td>
</tr>
<tr>
<td></td>
<td>3. Measurement of deflection accurately</td>
</tr>
<tr>
<td>18</td>
<td>Test on helical coiled springs</td>
</tr>
<tr>
<td></td>
<td>1. Measurement of diameter of coil wire, diameter of coil and no. of coils accurately</td>
</tr>
<tr>
<td></td>
<td>2. Measurement of deflection of springs</td>
</tr>
</tbody>
</table>

**COURSE CONTENT**
1. **Tests on Bricks**
   a) Water absorption
   b) Crushing strength

2. **Tests on Cement**
   a) Fineness test
   b) Normal consistency test
   c) Setting times of cement
   d) Compressive strength of cement.

3. **Tests on Aggregates**
   a) Water absorption of Sand
   b) Bulking of Sand
   c) To determine necessary adjustment for bulking of fine aggregate by
      Field method
   d) Bulk density and Percentage of voids in Coarse and fine aggregates
   e) Sieve analysis of coarse and fine aggregates
   f) Field method to determine fine silt in aggregate

4. **Tests on Metals**
   a) Tension test on mild steel rod
   b) Torsion test on mild steel rod
   c) Brinell/Rockwell - hardness test on steel and Brass with different surface finish
   d) Brinell/Rockwell - hardness test on steel and Brass with different surface finish
   e) Izod/Charpy tests on mild steel/brass.
   f) Deflection Test on beam (Steel beam or wooden beam)
   g) Test on closely coiled helical spring

**HYDRAULICS PRACTICE**

<table>
<thead>
<tr>
<th>Subject Title</th>
<th>HYDRAULICSPRACTICE</th>
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</thead>
<tbody>
<tr>
<td>Subject Code</td>
<td>CE-310</td>
</tr>
<tr>
<td>Periods/Week</td>
<td>03</td>
</tr>
<tr>
<td>Periods/Semester</td>
<td>45</td>
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</table>

**TIME SCHEDULE**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Determination of Hydraulic Coefficients / factors / Constant / Verification of Principles / Laws</td>
<td>36</td>
</tr>
</tbody>
</table>
OBJECTIVES

1.0 At the completion of the subject, the learner shall be able to perform an experiment to determine hydraulic coefficients/factors/constant/ Verification of Principles/ Laws

1.1 Determine coefficient of discharge of a small orifice by constant head method and variable head method.
   1.1.1 State the principle / law / apparatus / equipment required for testing.
   1.1.2 Perform test and record observations.
   1.1.3 Draw inferences on the relationship between parameters.
   1.1.4 Draw a graph between Q vs H^{1/2}.

1.2 Determine coefficient of discharge of a small orifice by variable head method.
   1.2.1 State the principle / law / apparatus / equipment required for testing.
   1.2.2 Perform test and record observations.
   1.2.3 Draw inferences on the relationship between parameters.
   1.2.4 Draw a graph between Q vs H^{1/2}.

1.3 Determine the hydraulic coefficients of an orifice.
   1.3.1 State the Relationship.
   1.3.2 Conduct test and record observations.
   1.3.3 Draw Conclusions.

1.4 Determine coefficient of discharge of a mouthpiece by constant head method.
   1.4.1 State the principle / law / apparatus / equipment required for testing.
   1.4.2 Perform test and record observations.
   1.4.3 Draw inferences on the relationship between parameters.
   1.4.4 Draw a graph between Q vs H^{1/2}.

1.5 Determine coefficient of discharge of a rectangular notch.
   1.5.1 State the Aim / apparatus / equipment required for testing.
   1.5.2 Perform test and record observations.
   1.5.3 State field application.
   1.5.4 Draw a graph between Q vs H^{3/2}.

1.6 Determine coefficient of discharge of a triangular notch.
   1.6.1 State the Aim / apparatus / equipment required for testing.
   1.6.2 Perform test and record observations.
   1.6.3 State Field application.
   1.6.4 Draw a graph between Q vs H^{5/2}.
   1.6.5 Compare results with rectangular notch.

1.7 Determine coefficient of discharge of a trapezoidal notch.
1.7.1 State the Aim/apparatus/equipment required for testing.
1.7.2 Perform test and record observations.
1.7.3 State field application.
1.7.4 Draw inferences comparing the result s with rectangular notch and triangular notch.

1.8 Verify Bernoulli’s theorem.
1.8.1 States the principle/law/apparatus/equipment required.
1.8.2 Perform test and record observations.
1.8.3 State Inference and application.
1.8.4 Plot Hydraulic gradient line and Total energy line.

1.9 Determine coefficient of discharge of a venturimeter.
1.9.1 State the Aim/apparatus/equipment required.
1.9.2 Perform test and record observations.
1.9.3 State Practical application.
1.9.4 Draw a graph between Q vs $H^{1/2}$.

1.10 Determine friction factor in pipe flow.
1.10.1 State the Aim/apparatus/equipment required.
1.10.2 Perform test and record observations.
1.10.3 State Importance of friction factor in pipe design.

1.11 Determine Chezy's constant in open channel flow.
1.11.1 State the Aim/apparatus/equipment required.
1.11.2 Perform test and record observations.
1.11.3 State Importance in design of section of open channel.

2.0 Study on Hydraulic machines.
2.1 Study on Reciprocating pump.
2.1.1 Identify the component parts of a reciprocating pump.
2.1.2 State the functions of each component.
2.1.3 State field applications.
2.2 Study on Centrifugal pump.
2.2.1 Identify the component parts of a reciprocating pump
2.2.2 State the functions of each component
2.2.3 State field applications and compare with Reciprocating pump.

2.3 Study on Hydraulic Turbines.
2.3.1 Identify the component parts of Pelton wheel, Francis or Kaplan turbines.
2.3.2 State function of each component.
2.3.3 State field applications.

### KEY Competencies to be achieved by the student

<table>
<thead>
<tr>
<th>S. No</th>
<th>Experiment Title</th>
<th>Key Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coefficient of discharge of small orifice by constant head</td>
<td>1. To regulate the flow</td>
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<tr>
<td></td>
<td></td>
<td>2. To operate stop clock accurately</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. To draw graph between Q vs $H^{1/2}$</td>
</tr>
<tr>
<td>2</td>
<td>Coefficient of discharge of small orifice by variable head</td>
<td>1. To note readings of head at intervals.</td>
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<tr>
<td></td>
<td></td>
<td>2. To operate stop clock accurately</td>
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<td>Experiment</td>
<td>List of Experiments</td>
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</tr>
<tr>
<td>1</td>
<td>To regulate flow.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>To note co-ordinate values and measure volume</td>
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<tr>
<td>3</td>
<td>To operate stop clock accurately</td>
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<tr>
<td>4</td>
<td>To state the relation.</td>
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<tr>
<td>5</td>
<td>To note readings of head</td>
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</tr>
<tr>
<td>6</td>
<td>To operate stop clock accurately</td>
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<tr>
<td>7</td>
<td>To draw graph between Q vs H^{1/2}</td>
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<tr>
<td>8</td>
<td>To note readings of head at various locations</td>
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<tr>
<td>9</td>
<td>To plot hydraulic gradient line and total energy line</td>
<td></td>
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<tr>
<td>10</td>
<td>To note readings of head</td>
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<tr>
<td>11</td>
<td>Observe the significance of friction factor of pipe flow.</td>
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<tr>
<td>12</td>
<td>To note readings of head</td>
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</tr>
<tr>
<td>13</td>
<td>Observe the significance in design of section of open channel</td>
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</table>

**COURSE CONTENT**

**LIST OF EXPERIMENTS**

I Determination of Hydraulic Coefficients/factors/Constant/Verification of Principles/ Laws
1. Determination of coefficient of discharge of a small orifice by constant head method
2. Determination of coefficient of discharge of a small orifice by variable head Method
3. Determination of Cc of an orifice by finding Cv and Cd.
4. Determination of coefficient of discharge of a mouthpiece by constant head method.
5. Determination of coefficient of discharge of a triangular notch.
6. Determination of coefficient of discharge of a rectangular notch.
7. Determination of coefficient of discharge of a trapezoidal notch.
8. Verification of Bernoulli’s theorem.
10. Determination of friction factor in pipe flow.
11. Determination of Chezy’s constant in open channel flow.

II Study of Fluid machines

12. Study on reciprocating pump and centrifugal pump.
13. Study on turbines – Pelton / Francis / Kaplan.

DIPLOMA IN CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester (SECOND YEAR)

<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Total Period / year</th>
<th>Scheme of Examination</th>
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<td>Theory of Structures</td>
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I-66
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<td>CAD Practice</td>
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### OBJECTIVES

After the completion of the subject the student shall be able to

1.0. **Understand the behaviour of columns under vertical loads**

1.1 Define: i) Compression member ii) Axial Loading

1.2 List different types of compression members

1.3 Define: i) Buckling / Critical / Crippling Load ii) Actual length iii) Least radius of gyration iv) Safe load v) Factor of safety

1.4 Calculate least radius of gyration for solid / hollow circular, square and rectangular sections

1.5 List different end conditions used for a column

1.6 Define i) Effective / equivalent length ii) Slenderness ratio

1.7 State the effective lengths of columns for different end conditions

1.8 Calculate the slenderness ratio for a given column/strut

1.9 State the classification of columns based on slenderness ratio or length and lateral dimensions

1.10 Distinguish between Long and short columns.

1.11 State Euler’s formula for crippling load of a column / strut (derivation not required)

1.12 Derive an expression showing limitations of Euler’s formula.

1.13 Solve problems on limitations of Euler’s formula

1.14 Calculate crippling and safe loads on a column / strut with simple / built up section using Euler’s formula

1.15 Explain the validity of Rankine’s formula for short and long columns using basic Rankine’s empirical formula

1.16 Obtain Rankine’s formula for crippling load of a column / strut from basic empirical formula

1.17 Calculate crippling or safe loads on a column / strut with simple / built up section using Rankine’s formula

1.18 Calculate the ratio of strengths of hollow and solid circular columns loaded under same conditions

1.19 Design a hollow circular cross section of a column for the given data

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1.20 Obtain the expression for pressure distribution at the base of a column, subjected to eccentric load about one axis only
1.21 Compute the pressure distribution at the base of a column, subjected to an eccentric load about one axis only
1.22 Define the core of a column
1.23 Calculate core for circular / square / rectangular columns and draw the shapes of core

2.0. Understand the Stability of Retaining walls and dams under the action of lateral pressures
2.1. Define a dam/retaining wall.
2.2. List the forces acting on a dam/retaining wall.
2.3. Derive the formula for maximum and minimum stress intensities at the base of a Trapezoidal dam with vertical water face.
2.4. Sketch the stress distribution at the base of a dam/retaining wall for different conditions.
2.5. Calculate the stress intensity at base of a rectangular / Trapezoidal dam with or without free board.
2.6. List the conditions for stability of a dam/retaining wall.
2.7. Define middle third rule.
2.8. Define minimum base width of a dam/retaining wall.
2.9. Derive the formula for minimum base width of a trapezoidal / rectangular / triangular sections of a dam without free board to avoid tension at the base.
2.10. Calculate the minimum base width based on above formulae.
2.11. Calculate the minimum base width of a trapezoidal dam with vertical water face and having free board to avoid tension and sliding.
2.12. Explain the procedure to find the stresses at the base of a dam with battered water face.
2.13. Calculate the stresses at the base of a dam with inclined water face.
2.14. Solve the problems on checking the stability of a dam with vertical / inclined water face.
2.16. Differentiate between active earth pressure and passive earth pressure.
2.17. Compute the lateral earth pressure on a retaining wall having soil face vertical with levelled earth, surcharged earth and with levelled earth and UDL.
2.18. Calculate the stresses at the base of a retaining wall for the above cases.
2.19. Calculate the minimum base width of a retaining wall with vertical soil face and levelled earth to avoid tension and sliding at base.
2.20. Calculate the stresses at the base of a retaining wall with levelled earth and soil face inclined.
2.21. Check the stability of a retaining wall with soil face vertical and having leveled / surcharged earth OR with soil face inclined and having levelled earth.
2.22. State Rankine’s formula for minimum depth of foundation.
2.23. Calculate minimum depth of foundation for walls and columns using Rankine’s formula.

3.0. Understand the effects of Loading on propped cantilevers, fixed and continuous beams
3.1. Differentiate between a statically determinate and indeterminate structure.
3.2. Define degree of static indeterminacy.
3.3. Calculate degree of static indeterminacy for a propped cantilever, fixed and two span continuous beams.
3.4. Calculate prop reaction of propped cantilever subjected to UDL throughout OR a single point load between fixed and propped ends.
3.5. Calculate SF and BM values and draw SFD and BMD for a propped cantilever with above type of loading only.
3.6. Calculate the location of point of contra flexure in propped cantilever for above loading.
3.7. State the merits and demerits of fixed beams.
3.8. Derive the conditions required for the analysis of fixed beams by moment area method.
3.9. Derive the formulae for the fixed end moments due to central point load or UDL throughout on a fixed beam.
3.10. Draw SFD and BMD for a fixed beam with above type of loading only.
3.11. State the formulae for maximum deflection in a fixed beam due to above loading.
3.12. Calculate the maximum deflection in a fixed beam using above formulae.
3.13. State the merits and demerits of continuous beams.
3.15. Calculate support moments and span moments for a two span continuous beam with simply supported or over hanging ends only, subjected to central point load or UDL throughout on each span, using theorem of three moments.
3.16. Calculate the support reactions for above type of continuous beams.
3.17. Draw SFD and BMD for two span continuous beams, using theorem of three moments.
3.18. Define stiffness factor, distribution factor and carry over factor.
3.19. Calculate stiffness factor and distribution factor at an intermediate support of a beam or non-hinged joint.
3.20. Calculate span moments and support moments for two span or three span continuous beams with different end conditions, carrying central point load or UDL throughout on each span, using moment distribution method.
3.21. Draw BMD only for the two span or three span continuous beams with the above type of loading and end conditions, using moment distribution method.

4.0. Understand the effect of Dead and Live loads on statically determinate frames
4.1. Define a frame.
4.2. Classify the frames based on number of members and number of joints.
4.3. Show the sign convention for different types of stresses in members of a truss / frame.
4.4. Explain the rules for assuming the direction of stresses in the members.
4.5. Explain the method of calculating stresses / forces in the members of a truss / frame by the method of joints.
4.6. Calculate the stresses / forces in the members of a simply supported or cantilever truss / frame subjected to DL & LL at nodal points by the method of joints and prepare force table.
4.7. Explain the method of calculating stresses / forces in the members of a truss / frame by the method of sections.
4.9. Calculate the stresses in the members of a simply supported or cantilever truss / frame subjected to DL & LL at nodal points by the method of sections and prepare force table.
COURSE CONTENT

1.0 Columns and struts
   a) Short and long columns – Axial loading only – solid circular, Hollow circular, Rectangle and I section and Built up columns – different end conditions – slenderness ratio – calculation of safe load on columns by Euler’s and Rankine’s formula – Effective length, radius of gyration and slenderness ratio - limitation of Euler’s formula – strength of columns – problems – stress distribution at the base of column due to eccentric load about one axis- problems – core of a column

2.0 Dams and retaining walls
   a) Introduction – rectangular dams – trapezoidal dams having water face vertical and inclined – Conditions for the stability of a dam – conditions to avoid tension in the masonry dam at its base, to prevent the over – turning of the dam, the sliding of dam and to prevent the crushing of masonry at the base of the dam – Minimum base width of a dam.
   b) Active and passive earth pressure – Angle of internal friction – Angle of surcharge – calculation of active earth pressure by Rankine’s formula with and without surcharge.
   c) General conditions of stability of retaining walls – middle third rule – Distribution of pressure on foundation of retaining walls – calculation of minimum base width.
   d) Calculation of minimum depth of foundation by Rankine’s formula.

3.0 Statically indeterminate beams
   a) Statically determinate and indeterminate structures – definition – degree of static indeterminacy
   b) Cantilever beam with UDL on whole span and propped at free end – cantilever beams with point load between fixed and propped ends – Calculation of prop reaction – SFD and BMD.
   d) Continuous Beams: Merits and demerits – Continuous beams – effect of continuous supports – support moments – Clapeyron’s Theorem of three moments – equation (without derivation) – continuous beams with central point load or U.D.L throughout for each span – problems on two span continuous beams with simply supported or over hanging ends only – Reaction at supports in continuous beams – sketching S.F.D and B.M.D (Beam with varying moments of inertia, supports at different levels not included)
   e) Moment distribution Method (Hardy cross method) – Introduction - Sign conventions – stiffness factor – carry over factor – Distribution factor – Application to continuous beams of Two span and three span with central point load or UDL throughout on each span (for any type of end support) - sketching
B.M.D. only (beam with varying moments of inertia, supports at different levels not included)

4.0 **Stresses in frames**
Frames – Definition – classification based on number of members and number of joints – Determination of forces in members of statically determinate pin jointed frames – method of sections and method of joints – Application to simple frames and trusses (simply supported and cantilever) under loads at joints.

**REFERENCE**

4. Strength of Materials by S. Ramamurtham
5. S.M and T.S – by B.C. Punmia
7. Graphical Methods in structural analysis by D S Prakash Rao
8. Structural Analysis – A Unified Approach by D S Prakash Rao
10. Strength of Materials – by R.K. Bansal

**QUANTITY SURVEYING - I**

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Time Schedule

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OBJECTIVES

After completion of the subject, the student shall be able to

1.0  Understand basic concepts of Quantity Surveying, Units and Specifications

1.1 Define:
   a) Quantity Surveying
   b) Estimate
1.2 State the need for quantity surveying
1.3 State different types of estimates & their need
1.4 Distinguish between element of structure, item of a work & materials of construction
1.5 State the duties of Quantity Surveyor
1.6 State the units of measurements, data and payment for different items of work and materials using I S : 1200
1.7 State the process of taking measurements for different works and tolerances
1.8 Define specification
1.9 State the need of specification
1.10 State different types of specifications
1.11 Give the general specifications for important items of work

2.0  Compute the volumes of earth work and reservoir capacity

2.1 Explain terms:
   a) Embankment
   b) Cutting
   c) Volume of earth work
2.2 Define:
   a) Lead
2.3 State the standard values of lead and lift
2.4 Calculate the lead and lift for a given section
2.5 State the different methods of computations of areas and volumes
2.6 Explain:
   a) Mean sectional area method
   b) Mid sectional area method
   c) Trapezoidal rule
   d) Prismoidal rule
2.7 State the limitations of prismoidal rule
2.8 Determine the areas of an embankment for a given data
2.9 Determine the areas of a cutting for a given data
2.10 Prepare detailed estimates for earth work for roads, canals and earthen bunds
2.11 Compute gross and effective capacity of a reservoir from the areas of different elevations

3.0 **Understand different types of estimates**
3.1 State different types of estimates
3.2 Explain:
   a) Approximate or preliminary estimate
   b) Detailed estimate
   c) Abstract estimate
3.3 State the methods of preparing approximate estimates
3.4 Explain:
   a) Plinth area method
   b) Cubic content method
   c) Service unit method
3.5 Prepare approximate estimates for residential and non-residential buildings with given data of size / capacity and rates considering cost of building services and other overheads
3.6 Differentiate between detailed estimate and abstract estimate
3.7 Write formats of detailed estimate and abstract estimate

4.0 **Prepare detailed estimates for various Civil Engineering Structures:**
4.1 State the information required for preparation of detailed estimates of a building
4.2 State different methods of taking out quantities
4.3 Explain different methods of taking out quantities
4.4 Prepare the detailed estimates for various buildings from the given drawings specifications and site conditions:
   a) Compound wall and Steps
   b) Single Room Building
   c) Single Room with Verandah
   d) Single storied Residential building with one bed room (1 BHK)
   e) Single storied Residential building with two bed rooms (2 BHK)
   f) Three Bed room building (3 BHK)
   g) Two storied residential building
   h) Buildings with Sloped roofs like pitched roof, lean to roof, hipped & valley roof
COURSE CONTENT

1. Introduction of Unit measurements and Specifications
   b) Units of measurements for various items of civil engineering works as per IS :1200
   c) Degree of accuracy in measurement – Deductions for openings in masonry, RCC and Plastering – Painting coefficients
   d) Different Methods of taking out quantities – Centre Line Method – Long and Short Wall Method
   d) Specifications – Necessity – Types of specifications – General specifications of:
      i) Earth works
      ii) Brick / Stone Masonry with C.M
      iii) Reinforced Cement Concrete
      iv) Plastering with C.M
      v) Floor finishes with ceramic tiles and marbles
      vi) White washing / Colour washing

2. Earth Work Calculations
   a) Lead and Lift – Initial and subsequent values
   b) Mid-Ordinate Method – Mean Sectional Area Method – Trapezoidal Rule – Prismoidal Rule for computing volumes in level sections for roads and Canals
   c) Taking out quantities from Longitudinal Section and Cross Section in cutting and embankment of level sections
   d) Capacity of Reservoir from the table of areas and contours

3. Types of Estimates of Buildings
   b) Preliminary or Approximate Estimate – Plinth area method – Cubic rate method – Service Unit method
   c) Problems in Preliminary estimate

4. Preparation of detailed estimates for various Civil Engineering structures with loading bearing walls
   Compound wall and steps
   a) Single Room Building
   b) Single Room with Verandah
   c) Single storied Residential building with one bed room (1 BHK)
   d) Single storied Residential building with two bed rooms (2 BHK)
   e) Three Bed room building (3 BHK)
   f) Two storied residential building
   g) Buildings with Sloped roofs like pitched roof, lean to roof, hipped & valley roof
   h) Estimation of a steel roof truss
i) Primary school building

Reference

1. Estimating and Costing - B.N. Dutta
2. Estimating and Costing - S. C. Rangawala

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## TIME SCHEDULE

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## OBJECTIVES

At the end this subject the student shall be able to

1.0 Understand the principals of Trigonometrical Levelling
   1.1. State the meaning of trigonometrical levelling
   1.2. Enumerate the different cases that occur in trigonometrical levelling to find the elevation and distance of a given object (base of the object accessible or inaccessible)
   1.3. Derive formula for finding height and elevation of an object when the base of the object is accessible.
   1.4. Calculate the height and elevation of an object when the base of the object is accessible.
   1.5. Derive the formula to find the distance and elevation of the object when the base of the object is inaccessible and instrument stations and object are in the same vertical plane
   1.6. Calculate the distance and elevation of the object when the base of the object is inaccessible and instrument stations and object are in the same vertical plane
   1.7. Describe the procedure to find the distance and elevation of the object when the base of the object is inaccessible and instrument stations and object are not in the same vertical plane.
   1.8. Calculate the distance and elevation of the object when the base of the object is inaccessible and instrument stations and object are not in the same vertical plane.
2.0 **Understand the principle of Tacheometry to find the elevations and distances of stations**

2.1 Define tacheometry

2.2 List the uses of tacheometry

2.3 Explain the principles of stadia tacheometry and Advantage of use of Analogue table

2.4 List the different methods of tacheometry

2.5 State the term staff intercept

2.6 List the constants of tacheometry in stadia tacheometry

2.7 Derive the formulae to determine the horizontal distance of staff station from the instrument station and also the elevation of the staff station using stadia tacheometry, when the line of collimation is horizontal with staff held vertical

2.8 Calculate the horizontal distance of staff station from the instrument station and its elevation when the line of collimation is horizontal with staff held vertical.

2.9 Explain the procedure for determining tacheometric constants

2.10 State the use of analytic lense

2.11 Write the formulae to determine the horizontal distance of staff station from the instrument station and also the elevation of the staff station using stadia tacheometry When the line of collimation is inclined with staff held vertical (without derivation)

2.12 Calculate the horizontal distance of staff station from the instrument station and its elevation when the line of collimation is inclined with staff held vertical.

2.13 Compute the horizontal distance and difference in elevations between any two staff stations (instrument station and staff stations are lying in the same vertical plane) using stadia tacheometry

2.14 Compute the horizontal distance and difference in elevations between any two staff stations (instrument station and staff stations are not lying in the same vertical plane) using stadia tacheometry

2.15 Explain the principle of Tangential Tacheometry

2.16 Enumerate the difference between Stadia and tangential tacheometries

2.17 Derive the formula to determine the distance of staff station from the instrument station and elevation of the staff station by tangential tacheometry

2.18 Compute the horizontal distance of staff station from instrument station and its elevation by tangential tacheometry

2.19 Compute the horizontal distance and difference in elevations between any two staff stations using tangential tacheometry (instrument station and staff stations are lying in the same vertical plane)

2.20 Compute the horizontal distance and difference in elevations between any two staff stations using tangential tacheometry (instrument station and staff stations are not lying in the same vertical plane)

3.0 **Understand the method of setting out simple curves**

3.1 List the types of horizontal curves

3.2 Define Simple curve
3.3 Define degree of curve and state the relation between the radius and degree of curve according to chord length / arc length
3.4 Calculate degree of curve using above relations
3.5 Sketch a simple circular curve and show its elements
3.6 Define various elements of a simple circular curve
3.7 Compute the length of curve, tangent length, length of long chord and mid ordinate, apex distance and chainages at salient points of a curve
3.8 List the linear and angular methods of curve setting
3.9 Explain the procedures for setting out a curve by linear methods
3.10 Explain the procedures for setting out a curve by angular methods
3.11 Calculate the data required for setting out a curve for above methods and Prepare the curve tables

4.0 **Understand the principles and uses of Electronic Surveying instruments**
4.1 List the modern surveying instruments
4.2 Explain the principle of EDM
4.3 Explain the features of electronic theodolite and distomat
4.4 State the uses of electronic theodolite and distomat
4.5 Define GPS
4.6 Explain the working principle of GPS
4.7 Explain the segments of GPS
4.8 Enumerate the types of GPS receivers
4.9 Explain taking coordinates of various points using GPS
4.10 List the applications of GPS in civil Engineering
4.11 List merits and demerits of GPS
4.12 Define GIS
4.13 State the components of GIS
4.14 List and explain the types of data used in GIS
4.15 Define map
4.16 List the types of map projections
4.17 List the uses and applications of GIS in civil Engineering
4.18 State the principle of Photogrammetry
4.19 Explain the types of terrestrial photogrammetry
4.20 Explain the use of stereoscope in photogrammetry

5.0 **Understand the principles of total station**
4.21 List the parts of total station and their functions
4.22 Explain the setting up total station for taking observations
4.23 List the uses of total station
4.24 Explain the procedure for measurement of distances and angles
4.25 Explain procedure of taking multiple number of observations on a single station
4.26 Explain the procedure for measurement of area with single station setup
4.27 Explain the procedure of traversing using total station
4.28 Explain the orientation of total station by resection method
4.29 Explain establishing TBM by station elevation method
4.30 Explain Stakingout a point, line and an arc
4.31 List the steps involved in marking the centre line for a typical residential building
4.32 Explain the procedure for LS and CS for proposed road / canal / pipe line

Course Content

1.0 Trigonometric levelling
   a) Principle and necessity of Trigonometric levelling
   b) Elevations and distances of objects whose base is accessible or inaccessible, with instruments stations and object in the same vertical plane or in different vertical planes.

2.0 Tacheometry
   a) Tacheometry – principle – uses – types – stadia and tangential tacheometries
   b) Stadia Tacheometry with staff held vertical and line of collimation horizontal or inclined – elevations and distances of staff stations – determination of Tacheometric constants - Tachometric tables - problems
   c) Tangential Tachometry – uses – Finding elevation and distances – Problems.

3.0 Curves
   a) Curves – types of horizontal curves – simple, compound and reverse curves – degree of curve – formulae for degree of curve using 20m / 30m chain – elements of simple circular curve – Point of commencement of curve, point of tangency, forward and back tangents, point of intersection, angle of intersection, deflection angle, length of curve, tangent length, long chord, mid ordinate, normal chord and sub chord
   b) Calculation of elements of simple circular curve
   c) Method of curve setting – chain and tape methods – offsets from long chord method, successive bisection of arcs method, off sets from tangent (radial and Perpendicular offsets) method and off sets from chords produced method – angular methods – single and double theodolite methods
   d) Preparation of curve table for curve setting – problems.

4.0 Electronic Survey instruments and GPS and GIS
   a) Principle and uses of EDM – Electronic theodolite and distomat – uses
   b) Global positioning system (G.P.S) – principle – segments – space, control and user segments – receivers – observation and data processing - applications in Civil Engineering – advantages and disadvantages of GPS
   c) Geographical Information System (GIS) – definition – Map – Map projections – types data used – use and application of GIS in Civil Engineering.
   d) Introduction to Photogrammetry – types of Photogrammetry – basic principles – terrestrial photogrammetry – stereo and plane table photogrammetries – stereoscope

5.0 TOTAL STATION
a) Parts and functions – setting up total station for taking observations - Use of Total Station - Measurement of distances and angles - multiple number of observations on a single station - measurement of area with single station setup - orientation of total station by resection method - establishing TBM by station elevation method - marking the centre line for a typical residential building - LS and CS for proposed road / canal / pipe line

REFERENCE

1 Surveying I & II
2 Surveying
3 Surveying and levelling I & II
4 Surveying - I & II
5 Text book of surveying

by B.C.Punmia
by S.K. Husain
by T.P Kanetkar
by A. V.R.J. Sharma and Kamala
by Dr C.venkat Ramaiah

TRANSPORTATION ENGINEERING

Subject Title : Transportation Engineering
Subject Code : CE-405
Periods/Week : 05
Periods/Semester : 75

TIME SCHEDULE
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<td>02</td>
</tr>
<tr>
<td>4</td>
<td>Introduction and Permanent way of Railways</td>
<td>10</td>
<td>13</td>
<td>01</td>
<td>01</td>
</tr>
<tr>
<td>5</td>
<td>Station yards and Maintenance of Railways</td>
<td>07</td>
<td>16</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>6</td>
<td>Bridges, Culverts and Cause ways</td>
<td>15</td>
<td>19</td>
<td>03</td>
<td>01</td>
</tr>
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<td>Total</td>
<td>75</td>
<td>110</td>
<td>10</td>
<td>08</td>
</tr>
</tbody>
</table>

**OBJECTIVES**

After completion of the subject, the student shall be able to

1.0  **Understand the basics of Highways and Soil Mechanics**

1.1.  State the importance of transportation engineering.
1.2.  State the importance and functions of I.R.C
1.3.  State the classification of roads as per I.R.C
1.4.  Explain the components of a road with a sketch.
1.5.  Defines the terms: width of pavement, shoulder, formation width, right of way, camber, gradient, super elevation, sight distance.
1.6.  State the different types of gradients and their recommended values.
1.7.  State the necessity of providing super elevation and write the formula.
1.8.  State the necessity of curves in highways.
1.9.  State the different types of horizontal and vertical curves adopted in road
1.10. List various physical properties of soils
1.11. State the definitions of various physical properties of soils.
1.12. State the different systems of classification of soils
1.13. Explain the textural classification soils with sketches as per I S Classification of soils.
1.15. State the presumptive bearing capacity values and the codes equation for the calculation of bearing capacity as per IS code.

2.0  **Understand Highway Survey and Traffic Engineering**

2.1.  Define the term alignment of road.
2.2.  State the factors influencing selection of alignment for a road in plain and hilly areas.
2.3.  List the surveys required for fixing alignment.
2.4.  State the different data required for the preparation of highway project.
2.5.  Explain various engineering surveys conducted to fix the alignment of a road.
2.6.  State the importance of traffic census/traffic surveys.
2.7.  List various traffic surveys conducted.
2.8 Explain with neat sketches traffic islands and Interchanges.
2.9 State the functions and types of pavement markings with sketches.
2.10 State the purposes and types of traffic signs with sketches.

3.0 Understand Highway construction and Maintenance
3.1 State the necessity of road drainage.
3.2 Explain the methods of providing surface and sub-surface drainage.
3.3 State the materials used in construction of different types of roads
3.4 List the tests on Bitumen.
3.5 State the equipment/machinery used in construction of different roads.
3.6 Explain the methods of construction of different types of roads.
3.7 Explain the maintenance of WBM of roads.
3.8 Explain the different types of joints used in C.C roads with sketches.
3.9 State the need for joints in C.C roads.

4.0 Understands Introduction and Permanent way of Railways
4.1 State the advantages of Railways.
4.2 Define gauge and state the classification of gauges.
4.3 State the component parts of a permanent way and functions of each component.
4.4 State the requirements/characteristics of good rail, rail joint, sleeper and ballast.
4.5 State the different types of rails, joints, rail fittings, sleepers, ballast, used in Indian Railways with sketches (wherever required).

5.0 Understand Station yard and Maintenance of Railways
5.1 Describe different types of turnouts and crossings with sketches.
5.2 State the classification of stations.
5.3 State different maintenance measures of a railway track.
5.4 State the duties of a permanent way inspector.

6.0 Understands Bridges, Culverts and Cause ways
6.1 State the classification of bridges based on materials, position of bridge floor and form/type of super structure.
6.2 State the factors influencing selection of site for a bridge.
6.3 State the data required for preparation of bridge project.
6.4 Defines terms: Waterway, linear waterway, afflux, vertical clearance, scour depth, free board.
6.5 State the formula for economical span and afflux.
6.6 State with sketches the different components of a bridge sub-structure and their functions.
6.7 Distinguish between deck and through bridge.
6.8 Draw different types of bridge super structures.
6.9 List different types of causeways and culverts.
6.10 State suitability of different types of culverts and causeways.
6.11 Sketch different types of causeways and culverts.

COURSE CONTENT

1. Introduction of Highway and Soil Mechanics
a) Importance of transportation engineering – I.R.C. – Classification of roads as per I.R.C.
b) Cross section of a road structure – sub grade – sub-base, base and wearing course-Width of pavement, shoulder, formation width, right of way, road boundaries – road widths for different classification of roads, traffic lane widths-camber – recommended I.R.C values of camber for different roads.
c) Gradients – Ruling gradient, limiting and exceptional gradients – Recommended I.R.C values of gradients.
e) Physical properties of soil like plasticity, cohesion, consolidation, compaction, Permeability and compressibility.
f) Soil moisture content – Specific gravity and density.
h) Different systems of classification of soils – Textural classification – I.S classification of soils
i) Bearing Capacity – Definition – Importance in foundation design
j) Presumptive bearing capacity (values only)
k) Code equation for computing bearing capacity (no derivation)

2. Highway Surveys and Traffic Engineering
   a) Alignment – Factors influencing alignment of road in plain and hilly areas – Highway surveys – Reconnaissance, preliminary and final location surveys.
   b) Traffic census and its importance.
   c) Road intersections – At grade intersections-Types–Traffic islands – Channelizing islands – Round about – Interchange – Fly over – Diamond intersections – Clover Leaf junction.
   d) Pavement marking and Kerb markings.
   e) Traffic signs – Informatory signs – Mandatory signs – Cautionary signs.

3. Highway constructions and Maintenance
   a) Purpose of road drainage – Surface and sub-surface drainage – Typical cross section of highway in cutting and embankment.
   c) Bitumen – Properties – Tests on Bitumen (Flash Point and consistency tests ) – Bitumen roads-Different types – Surface dressing – interface treatments-seal coat, tack coat, prime coat, premix – Full grout and semi-grout – methods – Construction procedure.

4. Introduction and permanent way of Railways
   a) Importance of Railways – Gauge – Types of gauges.
   b) Structure of permanent way-Different types of rails- requirements of a good rail.
   c) Rail joints – Types of joints – Requirements of good rail joint – Fixtures and fastenings of rails – coning of wheels.
e) Ballast – Definition – Function – Characteristics of good ballast.

5. Station yards and Maintenance of Railways
a) General description and sketches for turnout – General layout of a simple left hand and right hand turnout and different crossings.
b) General idea with sketches of station yards – Marshalling yard, goods yard, passenger yard and loco yard.
c) Maintenance of track – Duties of P.W.I (permanent way inspector).

6. Bridges, Culverts and Causeways
a) Bridges – Classification based on material, position of bridge floor and form/type of superstructure – Selection of site for a bridge.
b) Technical terms waterway, Afflux, vertical clearance, linear waterway, freeboard for bridges and culverts – Economical span – Scour depth .
c) Pier, abutment, wing wall and approaches – Functions of each.
e) Sketches and suitability of different culverts – slab culverts, pipe culverts and box culverts – Types of cause ways – Low level causeway and high level causeway.

REFERENCE

1. Highway Engineering by S.C. Rangawala
2. Railway Engineering by S.C. Rangawala
3. Bridge Engineering by S.C. Rangawala
4. Highway Engineering by Khanna and Justo
5. Railway Engineering by Saxena
6. A Text book of Road Engineering by Basu and Bhattacharjee

CAD PRACTICE

Subject Title : CAD PRACTICE
Subject Code : CE - 406
Periods/Week : 06
Periods/semester : 90
OBJECTIVES

After completion of the subject the student shall be able to

1.0 Computer aided drafting (CAD)
   1.1 States the applications and advantages of CAD
   1.2 States the features of CAD as drafting package
   1.3 States the hardware requirements to run CAD

2.0 Practices to start the CAD, drawing editor and selects/enters CAD Commands to perform any operations
   2.1 Studies the drawing editor screen.
   2.2 Practices the methods of selecting/entering commands to start new drawing accessing CAD commands by selecting from menus, tool bars and entering Commands on command line.
   2.3 Sets the limits of the drawing to get the needed working area.
   2.4 Practices the ‘setting commands’ Grid, Snap, & Ortho Commands.
   2.5 Practices ‘Draw commands’- point, line, pline, rectangle, circle, tangent, ellipse, arc, polygon and spline.
   2.6 Dimensions the given figures.
   2.7 Practices ‘modify commands’ – erase, copy, mirror, move, rotate, scale, stretch, trim, extend, break, chamfer, fillet, explode, Pedit, Mledit.
   2.8 Practices ‘construct commands’ – offset, array, Divide, measure.
   2.9 Practices ‘edit commands’ – Undo, Redo, Oops, CopyClip, PasteClip, Del.
   2.11 Practices ‘Hatch commands’ – Bhatch, Hatch.
   2.12 Practices ‘insert commands’ – Block, Wblock, Insert, Minsert.

3.0 Practices Geometric Constructions using CAD commands.
   3.1 Practices dividing a line into number of segments.
3.2 Practices drawing external/internal common tangents for circles of same/different radii.
3.3 Practices drawing external/internal common arcs for circles of same/different radii.
3.4 Practices construction of ellipse, parabola, hyperbola, cycloid, and helix.

4.0 Practices 2-D drawings using CAD Software.
4.1 Practices conventional signs used in civil engineering.
4.2 Practices drawing elevation of panelled door partly panelled and partly glazed door/window shutter.
4.3 Practices drawing cross section of Load bearing wall showing different components.
4.4 Practices drawing Plan, Elevation, section and site plan of one roomed building.
4.5 Practices drawing Plan, Elevation, section and site plan of 2BHK building.
4.6 Practices drawing Double line diagram of primary school building.
4.7 Practices drawing Plan of Rural Hospital.
4.8 Practices drawing typical floor Plan of Apartment.

5.0 Practices 3-D drawings using CAD Software.
5.1 Practices different views under view option.
5.2 Practices Solid creation and Solid editing options available in CAD.
5.3 Practices drawing different 3D solid objects.
5.4 Practices drawing 3D views of pyramids and isolated column footing.
5.5 Practices drawing Simple spread/wall foundation.
5.6 Practices drawing single/double roomed building in 3D.
KEY competencies to be achieved by the student

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Experiment Title</th>
<th>Key Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to computer</td>
<td>• Open/close Autocad program</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Understands Autocad Graphic User Interface(GUI) and various toolbars</td>
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<tr>
<td>2</td>
<td>Practice on CAD software</td>
<td>• Practices the methods of selecting/entering commands</td>
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<tr>
<td></td>
<td></td>
<td>• Sets the limits of the drawing</td>
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<tr>
<td></td>
<td></td>
<td>• Learns Draw commands</td>
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<tr>
<td></td>
<td></td>
<td>• Learns Modify commands</td>
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<td>• Learns Edit commands</td>
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<tr>
<td></td>
<td></td>
<td>• Learns View commands</td>
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<tr>
<td></td>
<td></td>
<td>• Learns Hatch commands</td>
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<tr>
<td></td>
<td></td>
<td>• Learns Dimensioning Commands</td>
</tr>
<tr>
<td>3</td>
<td>Geometric Constructions</td>
<td>• Draws simple geometrical shapes like circles, tangents</td>
</tr>
<tr>
<td>4</td>
<td>Preparation of 2-D drawings using CAD Software</td>
<td>• Draws 2-D drawings</td>
</tr>
<tr>
<td>5</td>
<td>Preparation of 3-D drawings using CAD software</td>
<td>• Learns 3-D commands</td>
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<tr>
<td></td>
<td></td>
<td>• Draws simple 3-D elements</td>
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<tr>
<td></td>
<td></td>
<td>• Draws 3-D views of Isolated Column footing</td>
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<td></td>
<td></td>
<td>• Draws 3-D views of wall foundation</td>
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<tr>
<td></td>
<td></td>
<td>• Draws 3-D views Single roomed and double roomed building in 3D</td>
</tr>
</tbody>
</table>

COURSE CONTENT

1.0 Introduction to computer aided drafting (CAD)
   a) Computer graphics
   b) Definition of CAD
   c) Applications of CAD
   d) Advantages of CAD
   e) Introduction to CAD as drafting package

2.0 Practices on CAD
   a) Study of drawing editor screen
   b) List out methods to access CAD commands.
   c) Practice of setting up of drawing area using utility commands, & using setting commands.
   d) Practice entity draw commands.
   e) Draw the given geometrical figures using draw commands.
   f) Practice of Modify commands.
   g) Practice of construct commands.
   h) Practice of edit commands
   i) Practice of view commands.
j) Practice of Hatch commands.
k) Practice of insert commands.
l) Dimension the figures using dimensioning commands.
m) Practice of Print/Plot commands

3.0 Geometric Constructions
a) Divide a line into number of segments.
b) Draw an external/internal common tangent for two given circles of same/different radii.
c) Draw external/internal arcs for two given circles of same/different radii.
d) Construct ellipse, parabola, hyperbola, cycloid, and helix.

4.0 Preparation of 2-D drawings using CAD Software
a) Draw conventional signs, symbols used in civil engineering drawing.
b) Draw the elevation of fully panelled door, partly glazed and partly panelled door/window shutter.
c) Draw the section of a load bearing wall.
d) Prepare Building Drawing – One roomed building with site plan.
e) Prepare Building Drawing - 2BHK building with site plan.
f) Prepare plan of primary school Building.
g) Prepare Plan of Rural Hospital building.
h) Prepare a typical floor plan of Apartment consisting G+5 floors.

5.0 Preparation of 3-D drawings using CAD Software
a) Practice 3D commands – View commands – solids command – solid editing/modify commands.
b) Draw 3-D view of different simple objects.
c) Draw the 3D view of Isolated Column footing.
d) Draw the 3D view of wall foundation.
e) Draw Single roomed and double roomed building in 3D.
BUILDING SERVICES DRAWING

Subject Title : Building Services Drawing
Subject Code : CE-407
Periods / week : 03
Periods / Semester : 45

TIME SCHEDULE

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Major Topics</th>
<th>Periods</th>
<th>Weightage of Marks</th>
<th>Short Answer Type</th>
<th>Essay Answer Type</th>
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<tbody>
<tr>
<td>1.</td>
<td>Plumbing</td>
<td>15</td>
<td>41</td>
<td>02</td>
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<tr>
<td>2.</td>
<td>Electrical</td>
<td>15</td>
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<tr>
<td>3.</td>
<td>Mechanical</td>
<td>15</td>
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<td>Total</td>
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<td>60</td>
<td>05</td>
<td>02</td>
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</table>

Note: All questions are to be answered. Part-A 5X4=20 marks & Part-B 2X20=40 marks

OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Label the component parts in plumbing
   1.1 Draw the water supply and sanitary pipe network diagram for a toilet
   1.2 Draw the water supply and sanitary pipe network diagram for a Kitchen room
   1.3 Draw the pipe networking diagram for a motor room
   1.4 Draw the plan and cross section sharing the water supply and drainage connections from water main to a residential building
   1.5 Draw the plan and cross section of a rain water harvesting pit in a residential building

2.0 Label the component parts in electrical connections
   2.1 Draw the wiring diagram for the following:
      (a) Two way switch
      (b) Connection to three phase motors
      (c) Connections in the Distribution board
   2.2 Draw the electrical layout diagram for a given residential building
3.0 **Label the component parts in mechanical connections**
   3.1 Draw the plan and cross section of a lift well and motor room sharing the lift machine accessories.
   3.2 Draw the plan and section of ducting air conditioning system for a given room.
   3.3 Draw the typical layout of a solar water heating system.

**COURSE CONTENT**

**I.0 Plumbing**
   1.1 Water supply and sanitary connections to a toilet
   1.2 Water supply and sanitary connections to a kitchen room
   1.3 Layout and network diagram for a motor room
   1.4 Water supply connections to a residential building
   1.5 Rain water harvesting pit
   1.6 Septic tank with details of connections to a soak pit

**2.0 Electrical engineering drawing**
   2.1 Labelling the parts of electrical connections in a residential building.
      a) Two way switch
      b) Three phase motor
      c) Distribution board
   2.2 Layout of a residential building and labelling the component parts.

**3.0 Mechanical Engineering Drawing**
   3.1 Lift well and motor room
   3.2 Ducting air conditioning system for a room
   3.3 Solar water heater system

**REFERENCE**

SURVEYING – III PRACTICE

Subject Title: SURVEYING – III PRACTICE  
Subject Code: CE - 408  
Periods/Week: 06  
Periods/semester: 90

TIME SCHEDULE

<table>
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<th>S.No.</th>
<th>Major Topics</th>
<th>No. of Sessions each of 3hours duration</th>
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<tr>
<td>1.</td>
<td>Field Exercises using Theodolite</td>
<td>07</td>
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<tr>
<td>2.</td>
<td>Setting out curves</td>
<td>05</td>
</tr>
<tr>
<td>3.</td>
<td>Field Exercises using Total Station</td>
<td>13</td>
</tr>
<tr>
<td>4.</td>
<td>Global Positioning System</td>
<td>03</td>
</tr>
<tr>
<td>5.</td>
<td>Digitization of Maps* (only Demo)</td>
<td>02</td>
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<td><strong>Total</strong></td>
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</table>

* In case facilities for digitization are not available, these sessions may be utilized for Topic at s.No.1(Theodolite survey).

OBJECTIVES

After completion of the subject, the student shall be able to

1.0. **Using Theodolite**
   1.1 Determine the Height and Reduced Level of an object whose base is accessible.
   1.2 Determine the Height and Reduced Level of an object whose base is inaccessible. (Object, instrument stations are in the same vertical plane)
   1.3 Determine constants ‘K’ and ‘C’.
   1.4 Determine Horizontal Distance and Elevation by principle of stadia Tacheometry.

2.0. **Sets out Simple curve**
   2.1 Using Chain and Tape.
   2.2 Using One Theodolite.
   2.3 Using Two Theodolites.

3.0. **Field Exercises using Total Station**
   3.1 Study of component parts, accessories and functions Total Station.
3.2 Initialization of Total Station over ground station and measure the distance between two given points.
3.3 Measure area of given field.
3.4 Conduct traversing survey (closed Traverse).
3.5 To find Height and width of an elevated object.
3.6 To determine the elevation of Instrument point by making observation to point with known elevation.
3.7 To measure multiple sets (rounds) of observations.
3.8 To perform a station setup on a known point by making observations to one or more back sight points.
3.9 To establish the position of an occupied point relative to a base line or a boundary line.
3.10 To mark or establish points, Lines and Arcs on the ground.
3.11 To mark Centre line of a building on the ground.
3.12 L.S and C.S of proposed road/canal/pipe line on the ground.
3.13 Understand post processing.
3.14 To plot contour map of an area using surfer software.

4.0. Global positioning system
4.1 Identifies the parts and the functions of Global Positioning System.
4.2 Determines the Coordinates of various points on the ground.
4.3 Linking the G.P.S data with Total Station.

5.0. Digitization of Maps
5.1 Study the concept of digitization.
5.2 Digitization of any given contour map.
5.3 Digitization of given Town map and creating different layers for roads, railways, water supply lines and drainage lines etc.,
### KEY competencies to be achieved by the student

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Experiment Title</th>
<th>Key Competency</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Field Exercises using Theodolite</td>
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</tr>
<tr>
<td></td>
<td>a) Ex 1.1</td>
<td>• Finds the height and reduced level of an object whose base is accessible</td>
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<tr>
<td></td>
<td>b) Ex1.2</td>
<td>• Finds the height and reduced level of an object whose base is inaccessible</td>
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<td></td>
<td>c) Ex1.3</td>
<td>• Calculates constants K &amp;C</td>
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<td>d) Ex1.4</td>
<td>• Finds Horizontal Distance and Elevation of an object</td>
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<td>2</td>
<td>Setting out curves</td>
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<tr>
<td></td>
<td>a) Ex 2.1</td>
<td>• Sets out a given simple curve using chain and tape</td>
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<tr>
<td></td>
<td>b) Ex 2.2</td>
<td>• Sets out a given simple curve using one Theodolite</td>
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<tr>
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<td>c) Ex 2.3</td>
<td>• Sets out a given simple curve using Two Theodolite</td>
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<tr>
<td>3</td>
<td>Field Exercises using Total Station</td>
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<tr>
<td></td>
<td>a) Ex3.1</td>
<td>• Places total station on tripod, checks batteries and switches on total station</td>
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<tr>
<td></td>
<td>b) Ex3.2</td>
<td>• Centering of total station over a given point and sighting reflecting prism to</td>
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<td></td>
<td>c) Ex3.3</td>
<td>measure distance</td>
</tr>
<tr>
<td></td>
<td>d) Ex3.4</td>
<td>• Measure area of given field</td>
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<td></td>
<td>e) Ex3.5</td>
<td>• Conduct traversing survey (closed Traverse) and gets plotting</td>
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<td></td>
<td>f) Ex3.6</td>
<td>• Finds Height and width of an elevated object</td>
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<td>g) Ex3.7</td>
<td>• Finds the elevation of Instrument point by making observation to point with</td>
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<td>h) Ex3.8</td>
<td>known elevation</td>
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<tr>
<td></td>
<td>i) Ex3.9</td>
<td>• Understands errors by taking multiple sets (rounds) of observations</td>
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<td>j) Ex3.10</td>
<td>• Knows station setup on a known point by making observations to one or more</td>
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<tr>
<td></td>
<td>k) Ex3.11</td>
<td>back sight points</td>
</tr>
<tr>
<td></td>
<td>l) Ex3.12</td>
<td>• Establish the position of an occupied point relative to a base line or a</td>
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<td></td>
<td>m) Ex3.13</td>
<td>boundary line</td>
</tr>
<tr>
<td></td>
<td>n) Ex3.14</td>
<td>• Establish points, Lines and Arcs on</td>
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<tr>
<td></td>
<td>the ground</td>
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<tr>
<td></td>
<td>Locates Centre line of a building on the ground</td>
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<td></td>
<td>Collects data for L.S and C.S of proposed road/canal/piper line on the ground</td>
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<td></td>
<td>Understand post processing</td>
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<tr>
<td></td>
<td>Plots contour map of an area using SURFER software</td>
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<tr>
<td>4</td>
<td>Global Positioning System</td>
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<tr>
<td></td>
<td>a) Ex 4.1</td>
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</tr>
<tr>
<td></td>
<td>b) Ex4.2</td>
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<tr>
<td></td>
<td>c) Ex4.3</td>
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<tr>
<td></td>
<td>Identifies the parts and the functions and learns operating GPS</td>
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<tr>
<td></td>
<td>Determines the Coordinates of various points on the ground</td>
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<td>Linking the G.P.S data with Total Station</td>
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<td>Understands software</td>
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<td>Digitizes of any given contour map.</td>
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<td>Digitizes of given Town map and creating different layers for roads, railways, water supply lines and drainage lines etc.,</td>
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COURSE CONTENT

1.0. Field Exercises using Theodolite
   a) Determination of Height and Reduced Level of Top and Bottom of Accessible Object.
   b) Determination of Distance and Elevation of an inaccessible object involving two instrument stations.
   c) Determination of Constants of Tacheometer.
   d) Determination of Horizontal distance and elevation by stadia Tacheometry.

2.0. Setting out curves
   a) Setting out a simple curve by chain and tape method.
   b) Setting out a simple curve by one Theodolite and two Theodolite methods.

3.0. Field Exercises using Total Station.
   a) Study of the Total Station equipment.
   b) Station setup and measuring distance.
   c) Measurement of area.
   d) Traversing with total station.
   e) Height and width of the elevated object.
   f) Orientation of Total Station by resection method.
   g) Establishing T.B.M by Station Elevation Method.
   h) Measure rounds (multiple sets of observations on a single station).
   i) Station setup plus.
   j) Recline.
   k) Staking out a point, line and an arc.
   l) Marking of the centre line for proposed residential building.
   m) L.S and C.S of a proposed road/Canal/pipeline.
   n) Contouring.
   o) Post processing.

4.0. Global positioning system
   a) Applications of Global Positioning System
   b) Parts and the functions of G.P.S.
   c) Finding the Coordinates of various points on the ground.
   d) Linking G.P.S data with Total Station.

5.0. Digitization of Maps
   a) Introduction – uses and applications.
   b) Raster to vector conversion – scanning - Digitization.
   c) Digitization of contour map from scanned picture.
   d) Digitization of Town maps – showing the different layers for roads, railways, water supply lines and drainage lines etc.
### DIPLOMA IN CIVIL ENGINEERING
**SCHEME OF INSTRUCTIONS AND EXAMINATIONS**
**V Semester (THIRD YEAR)**

<table>
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<tr>
<th>Subject Code</th>
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<th>Instruction period / week</th>
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DESIGN AND DETAILING OF R.C. ELEMENTS

Subject Title : DESIGN AND DETAILING OF R.C. ELEMENTS
Subject Code : CE-501
Periods/Week : 05
Periods/Semester : 75

TIME SCHEDULE

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OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Understand the Loads to be considered and importance of IS Codes and principles of working stress design
   1.1 Differentiate Cement concrete and reinforced cement concrete.
   1.2 Explain the necessity of reinforcement in plain concrete
   1.3 Explain the advantages and disadvantages of R.C.C.
   1.4 Know the material used in R.C.C. and their function in R.C.C.
   1.5 know the reasons for using steel as reinforcement.
   1.6 Know the different codes used
   1.7 Know the Loads to be considered in the design of R.C. elements.
   1.8 State the different methods of designing R.C. elements.
   1.9 Know the different grades of concrete and different permissible stresses in concrete (Working Stress Method) as per IS 456 – 2000.
   1.10 Differentiate the nominal mix concrete and design mix concrete.
   1.11 Know the equations of tensile strength and modulus of elasticity of concrete as per IS 456 – 2000.
   1.12 Know the properties of concrete: Poisson’s ratio, creep, shrinkage, workability and unit weight.
   1.13 Know the different types of steel and different permissible stresses in steel (Working Stress Method) as per IS 456 – 2000.
   1.14 Know the modulus of elasticity and unit weight of steel.
   1.15 State the assumptions made in Working Stress Method as per IS 456 – 2000.
   1.16 Define modular ratio, know the equation of modular ratio in working stress method
   1.17 Know the stress distribution and transformed area of R.C. section.
1.18 Define the effective depth, neutral axis, lever arm, moment of resistance.
1.19 Describe briefly balanced, under reinforced, over reinforced sections with sketches.
1.20 Calculate the neutral axis, lever arm and moment of resistance of a singly reinforced rectangular beam.
1.21 Design of singly reinforced rectangular beam subjected to flexure.

2.0 Introduction to Limit state Design
2.1 Define Limit State.
2.2 State different limit states.
2.3 Distinguish ‘strength’ and ‘service ability’ limit states
2.4 Know the different IS: 456 – 2000 code provisions for Limit state method of design.
2.5 Define the ‘characteristic strength’ of materials and ‘characteristic loads’
2.6 Differentiate ‘Nominal Mix’ and ‘Design Mix’
2.7 Explain the role of partial safety factors in limit state design.
2.8 Define ‘Design strength of materials’ and ‘Design loads’
2.9 State the assumptions made in the limit, state design.
2.10 State the differences between the working stress method and limit state method of design of R.C. elements.

3.0 Understand the principles of analysis and design of singly reinforced and doubly reinforced R.C.C rectangular beams, by limit state method
3.1 Draw the Stress diagram, strain diagram for a singly reinforced rectangular beam indicating appropriate stress and strain values in compression zone and tension zone of the beam, also the strain value at the junction of parabolic and rectangular stress blocks.
3.2 Calculate the depth of rectangular and parabolic stress blocks.
3.3 Calculate the total compressive force and total tensile force resisted by the singly reinforced rectangular beam.
3.4 Calculate the depth of neutral axis from the equilibrium condition
3.5 Define lever arm and write the equation for lever arm for a singly reinforced rectangular beam.
3.6 Define critical or balanced section, under reinforced section and over reinforced section.
3.7 Explain - why the over reinforced sections are not recommended?
3.8 Calculate the maximum depth of neutral axis.
3.9 Calculate the limiting value of moment of resistance with respect to concrete and steel
3.10 Calculate the limiting percentage of steel.
3.11 Know the general design requirements for beams in limit state design as per IS 456 – 2000 (Effective span, limiting stiffness, minimum tension reinforcement, maximum tension reinforcement, maximum compression reinforcement, spacing of main bars, Cover to reinforcement, side face reinforcement.)
3.12 Calculate the depth of neutral axis for a given section and decides the section is balanced or under reinforced or over reinforced and accordingly calculates the moment of resistance for the respective case.
3.13 Calculate the area of steel for a given beam with given cross section and loading.
3.14 Design a singly reinforced beam as per IS 456 – 2000 for flexure only with the given grade of steel and concrete and check the designed beam for deflection as per IS 456 – 2000.

3.15 Know the effect of shear on beam.

3.16 Explain the shear stress distribution across a homogeneous section and reinforced concrete section With sketches..

3.17 Know the design shear strength and maximum shear stress in different grades of concrete as per IS 456 – 2000.

3.18 Know the necessity of shear reinforcement and different forms of shear reinforcement provided in beams.

3.19 Know the critical section for shear.

3.20 Calculate the shear strength of concrete, shear resistance of vertical stirrups, shear resistance of bent up bars as per IS 456 – 2000.

3.21 Know the minimum shear reinforcement and maximum spacing of shear reinforcement as per IS 456 – 2000.

3.22 Calculate the nominal shear stress, shear resisted by bent up bars and spacing of vertical stirrups.

3.23 Design the shear reinforcement for beams.

3.24 Design a singly reinforced beam as per IS 456 – 2000 with the given grade of steel and concrete and check the designed beam for shear and deflection as per IS 456 – 2000 and design the shear reinforcement as per 456 – 2000.

3.25 State the situations which require doubly reinforced beams.

3.26 Determine the moment of resistance for a given doubly reinforced section (given d’/d – fsc values)

3.27 Design a doubly reinforced beam with the given data.

3.28 Calculate the allowable working load on singly reinforced and doubly reinforced beam for the given span.

3.29 Calculate the development length of bars in compression, tension, and the curtailment position for main tension bars. State the importance of anchorage values of reinforcement.

3.30 Design a singly / doubly reinforced simply supported rectangular beams for the given grades of materials, span and loading, for flexure including shear design with the curtailment of reinforcements and check for the deflection using simplified approach of the code.

3.31 Design an independent lintel subjected to triangular loading.

4.0 Understand the principles involved in the design of R.C.C slabs by Limit state method

4.1 Distinguish one-way slabs and two way slabs.

4.2 List the types of slabs based on support condition.

4.3 Know the general design requirements of slabs as per IS 456 – 2000.

4.4 Know the functions of distribution steel in slabs.

4.5 Sketch the general reinforcement details for a a) one way slab simply supported on two parallel sides and b) one way slab simply supported on four sides. c) two way simply supported slab d) one way continuous slab, e) cantilever slab continuous over a support and f) slab cantilevering from the top of a beam.

4.6 Know the edge strip and middle strip of a two way slab.
4.7 Sketch the general reinforcement details for a continuous two way slab for its edge strip and middle strip using straight bars and bent up bars.

4.8 Design one-way slab for given grades of materials, loads and span for flexure and including shear check, check for deflection using stiffness criteria.

4.9 Understand Load distribution in two-way slabs. Design two-way slab with different end conditions for flexure including shear using B.M and S.F coefficients. Provide torsional reinforcement in the restrained slabs. Check the deflection using simplified approach of stiffness criteria.

4.10 Classify the stairs based on the structural behavior or support condition.

4.11 Sketch the detailing of reinforcement in stairs spanning longitudinally (Dog legged staircase).

5.0 Understand the principles involved in the analysis of T-beams

5.1 Distinguish a T-beam and L-beam.

5.2 List the advantages of a T-beam.

5.3 Know the formula for effective width of flange of a T-beam and L-beam as per IS 456 – 2000.

5.4 Calculate the effective width of flange of an isolated T-beam as per IS 456 – 2000.

5.5 Describe the three cases of determining Neutral axis of T-beams with sketches and notations.

5.6 Calculate the depth of neutral axis and moment of resistance of the given Tee section using the expressions given in the code.

5.7 Know the minimum and maximum reinforcement in T-beams as per 456 – 2000.

6.0 Understand the principles involved in the design of Continuous beams and slabs

6.1 Explain the behavior of continuous beams and slabs subjected to loading.

6.2 List the advantages of continuous beams or slabs.

6.3 Draw the line diagram of a continuous beam or slab and indicate the bending moment and shear force values at salient points as per IS 456 – 2000.

6.4 Know the position of sagging (+ve) and hogging (-ve) bending moments along the continuous beam or slab.

6.5 Sketch the general reinforcement details for a continuous beam or slab.

6.6 Calculates the B.M and S.F of continuous beams and slabs (Minimum of three spans) at critical sections using B.M and S.F coefficients given in the code.

6.7 Design a continuous beam or slab as per code at a given section only.

7.0 Understand Analysis and Design of columns

7.1 Define a column/ compression member

7.2 Differentiate column, strut, pedestal, post

7.3 Know the necessity of providing reinforcement in column.

7.4 Understand the behavior of column under loading

7.5 Classify the columns based on type of reinforcement.

7.6 Classify the columns based on type of loading.

7.7 State the effective length of column for different end conditions as per theory and as per code.

7.8 Classify the columns based on slenderness ratio.

7.9 Define effective length of a column.

7.10 Know the slenderness limits for column to avoid buckling of column.
7.11 Know the minimum eccentricity of column.
7.12 Calculate the load carrying capacity of a short column with lateral ties and with helical reinforcement as per IS 456 – 2000.
7.13 Differentiate between short and long columns and understand their failure behavior.
7.14 Understand the design requirements of columns as per IS 456 – 2000.
7.14 Designs a Short Square, rectangular, circular column with lateral ties (subjected to axial load only).

8.0 Understand Design of Footings
8.1 Define Footing and States different types of Footings (Square/ Rectangular Isolated footings of Uniform/Tapered sections).
8.2 Know the Rankines's formula for minimum depth of foundation.
8.3 Understand the code provisions for the design of R.C.C footings.
8.3 Explain the procedure of checking the footing for one-way shear, two-way shear, bearing stress and for development length.
8.5 Design of an isolated square footing of uniform thickness under a column for flexure only.

Note: Students may be encouraged to use design aid SP-16, SP-34 and SP-23 for design of slabs, beams for general practice. I.S.456 – 2000 is allowed in the Examination.

COURSE CONTENT

1.0 Introduction to R.C.C and Principles of working stress method
1.1 Introduction to R.C.C, advantages and disadvantages of R.C.C., Loads to be considered and Introduction to I.S Codes and Assumptions in working stress method.
1.2 Behavior of concrete and steel under working loads.
1.3 Modular ratio – critical percentage of steel.
1.4 Balance, under reinforced, over reinforced sections.
1.5 Critical and actual neutral axis depth of singly reinforced beams.
1.6 Moment of resistance of simply supported singly reinforced beam sections.
1.7 Design of singly reinforced rectangular beam for flexure.

2.0 Philosophy of limit state Design
2.1 Codes of practice of R.C.C design
2.2 Characteristic compressive strength, modulus of elasticity of concrete.
2.3 Nominal Mix – Design Mix – differences.
2.4 Loads to be adopted in R.C.C. design – dead load, Live load, wind load(as per IS 875-1987) and earth quake loads( as per IS-1893).
2.5 Strength and serviceability limit states, characteristic strength of materials and characteristic loads and partial safety factors.
2.6 Design strength of materials and design loads.
2.7 Assumptions made in the limit state design.

3.0 Analysis and design of Rectangular beams
3.1 Stress-strain diagram of singly reinforced RCC beam.
3.2 Depth of neutral axis, lever arm.
3.3 Moment of resistance of singly reinforced Rectangular section – balanced, under reinforced.

3.4 Critical percentage of steel.

3.5 Calculation of moment of resistance of the given section and design of singly reinforced rectangular beam for the given load as per IS 456-2000.

3.6 Doubly reinforced sections - necessity, use.

3.7 Calculation of neutral axis and moment of resistance for the given section and grades of concrete and steel (no derivation of the equations).

3.8 Shear in singly reinforced beams - nominal shears stress, permissible shear stress.

3.9 Methods of providing shear reinforcement in the form of vertical stirrups - combination of vertical stirrups and bent up bars.

3.10 Code provisions for spacing of stirrups and minimum shear reinforcement (no derivation of equations).

3.11 Development of bond stress in reinforcing bars.


3.13 Curtailment of tension reinforcement.

3.14 Simple problems on development length.

3.15 Design of simply supported singly and doubly reinforced rectangular beam for flexure including shear and check for deflection using stiffness criteria - Use of design aids (SP-16).

3.16 Design of an independent lintel subjected to triangular loading.

4.0 Design of slabs

4.1 Slabs as structural and functional members

4.2 One way and two way slabs

4.3 Minimum reinforcement and maximum spacing of reinforcement – concrete cover -stiffness criterion- stiffness ratios for simply supported, cantilever and continuous slabs.

4.1 One way and two way slabs with various end conditions as per I.S:456 code.

4.2 Design of one-way slab for flexure and shear for the given grades of concrete, steel, span and loading.

4.4 Check for deflection using simplified approach of stiffness criteria.

4.5 Design of two-way slabs with different end conditions, using B.M and S.F coefficients for the unrestrained and restrained conditions as per code.

4.6 Design of torsion reinforcement for the restrained slabs – Deflection check using stiffness criteria - Use of design aids (SP-16).

4.7 Detailing of reinforcement in stairs spanning longitudinally.

5.0 Design of T-beam

5.1 Conditions needed for design of a beam as T-Section–advantages Code provisions for effective flange width - three cases of tee beams.

5.2 Neutral axis, lever arm and moment of resistance for under reinforced, balanced sections using the equations given in the code (no derivations).

5.3 Calculation of the moment of resistance of tee section using the equations given in the code – Use of design aids (SP-16).

6.0 Design of Continuous beams and Slabs

6.1 Behavior of continuous members and advantages of continuous beams and slabs.
6.2 Determination of B.M and S.F of continuous beams and slabs of minimum three spans using BM & SF coefficients given in the code-Use of design aids(SP-16).

6.3 Design the tension and shear reinforcement at a given section only.

7.0. **Design of columns**

7.1 Definition of column – Difference between Column and Pedestal.

7.2 Types of columns (Long and Short) - effective length for different end conditions.

7.3 Code provisions for design of columns- square, rectangular and circular columns with lateral ties

7.4 Determination of Load carrying capacity of short column- square, rectangular, circular, helically reinforced column subjected to axial load only.

7.5 Design of short square, rectangular and circular columns (with lateral ties only).

8.0 **Design of Footings**

8.1 Footings - Need for footings

8.2 Footings under isolated columns – loads on footings

8.3 Code provisions for design of footings - size of footings for given bearing capacity

8.4 Procedure of checking the footing for one-way shear, two-way shear, bearing stress and for development length.

8.5 Design of an isolated square footing of uniform thickness under a column for flexure only.

**REFERENCE:**

1. I.S:456- 2000
2. I.S:875-1987
3. Limit state design of R.C.C structures’ by Ashok K.Jain, Nem chand brothers, Roorkee.
5. Structural Engineering(RCC) by Ramamrutham.
8. Reinforced Concrete Structures by I.C.Syal and A.K.Goyal
9. Limit state design of reinforced concrete by P.C. Verghese
10. Concrete technology and practice by M.S Shetty
13. Reinforced Concrete Design by S, Unnikrishnan Pillai & Devdas Menon
    Tata Mc Graw Hill
14. Reinforced Concrete Design by S.N. Sinha ( Tata Mc Graw Hill)
ENVIRONMENTAL ENGINEERING – I

Subject Title : Environmental Engineering - I
Subject Code : CE-502
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

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OBJECTIVES

After completion of the subject, the student shall be able to:

1.0 Know about Environment and Ecology
   1.1 Define Environment.
   1.2 Define Ecology and Ecosystem.
   1.3 Understand the various global environmental issues.
   1.4 Define the terms Acid rain, Green house effect, global warming and Ozone layer depletion.
   1.5 List the causes and effects of Acid rain, Green house effect, global warming and Ozone layer depletion.
   1.6 Differentiate renewable and non-renewable energy sources.
   1.7 List examples for renewable and non-renewable energy sources.
   1.8 List the components of Ecosystem.
   1.9 Explain the flow of matter and energy in an ecosystem.
   1.10 List the factors affecting the stability of an ecosystem.
   1.11 Explain the concept of sustainable development.

2.0 Know the scheme of water supply
2.1 know the necessity of water supply schemes in the present day civil life.
2.2 understand the connection between water supply engineering and public health.
2.3 State the need of protected water supply.
2.4 List the objectives of a protected water supply scheme.
2.5 Draw the flow chart of a typical water supply scheme of a town.
2.6 List the factors affecting per capita demand of a town/city.
2.7 State the requirements of water for various purposes:
   (i) Domestic purpose (ii) industrial use (iii) fire fighting
   (iv) Commercial and institutional needs (v) Public use.
2.8 Explain the variation in demand for water supply.
2.9 Estimate the quantity of water required by a metropolitan area.
2.10 State the per capita demand for a small town for various purposes with a population of 50000
2.11 State the necessity of forecasting population in the design of water supply scheme.
2.12 State different methods of forecasting of population.
2.13 Work out simple problems on forecasting population by different methods.

3.0 Understand the different sources and conveyance of water
3.1 State the common sources of water for a water supply scheme.
3.2 State different types of surface sources of water.
3.3 State different types of sub surface sources of water.
3.4 State the merits and demerits of surface and ground water sources for a water supply scheme of a town.
3.5 State the salient features of various surface sources.
3.6 Define terms: Aquifer, aquiclude and Ground water table.
3.7 State the classification of wells according to construction.
3.8 Define the terms: draw down, critical depression of head, circle of influence, cone of depression, confined and unconfined aquifer, specific yield.
3.9 Explain the procedure for determining yield of a well by pumping tests (Constant Pumping and Recuperation Tests).
3.10 Explain with sketches:
   (i) Infiltration galleries.
   (ii) Infiltration wells.
3.11 Describe with sketches the intakes for collection of water. (reservoir intake, river intake, canal intake and lake intake).
3.12 Explain the different methods of conveyance of water.
3.13 Discuss as to why the raw water is carried from its source to city treatment plant through pressure conduits only.
3.14 Lists the merits and demerits of different types of pipes used for conveyance of water.
3.15 Explain with sketches the different joints used for connecting pipes.
3.16 Describe the standard method followed in laying and testing the water supply mains.
4.0 Understand the Quality as per IS code and methods of purification of water

4.1 state the different types of impurities present in water.

4.2 State the need for laboratory tests for testing water.

4.3 Explain the method of obtaining samples for testing.

4.4 Explain the different tests for analyzing quality of water with their significance.

4.5 Define: E-coli index, most probable number (MPN).

4.6 Explain the significance of E-Coli in water analysis.

4.7 Explain the importance of chemical and bacteriological analysis of water used for domestic purpose.

4.8 State the various water borne diseases in India.

4.9 State the maximum acceptable limits of the following for the public drinking water: a. Turbidity b. Hardness c. Nitrates d. Fluorides

4.10 State the objectives of treatment of water.

4.11 Sketch the overall layout of a water treatment plant indicating the different stages.

4.12 list the points to be considered in the location and layout of treatment plant.

4.13 State the objects of aeration, plain sedimentation, sedimentation with coagulation, filtration and disinfection.

4.14 Explain the process of aeration, plain sedimentation, sedimentation with coagulation, filtration.

4.15 Describe the different types of sedimentation tanks.

4.16 Describe the construction and operation of slow sand, rapid sand and pressure filters and compares them.

4.17 Know the type of filters suitable for public purpose, industrial use and swimming pools.

4.18 Define the term disinfection of water and the need of disinfecting water.

4.19 Explain the methods of disinfection of water.

4.20 Explain the different forms and points of Chlorination.

4.21 Know the substances responsible for causing colour, taste and odour in water.

4.22 Understand the temporary hardness and permanent hardness of water.

4.23 Explain various methods of removal of hardness of water.

*NOTE: no design of treatment units.

5.0 Understand the systems of distribution and Water supply arrangements in Buildings

5.1 State the requirements of good distribution system.

5.2 Mention the classification of distribution system.

5.3 Explain with sketches the different systems of distribution.

5.4 State the different methods of water supply system.

5.5 Explain different methods of water supply system with their merits and demerits.

5.6 State the necessity for service reservoirs.

5.7 Draw sketches of rectangular overhead service reservoir showing all
accessories.

5.8 Explain with sketches the different layouts in distribution system.
5.9 List the merits and demerits of layouts with their suitability for a given locality.
5.10 List various appurtenances used in a distribution system of water supply system to a town.
5.11 Explains with sketches the location and functioning of various appurtenances used in a distribution system of water supply.
5.12 Explain methods of detecting leakages.
5.13 Explain methods of rectification and prevention of leakages in water supply mains.
5.14 Define terminology used while making water supply arrangements in buildings.
5.15 State the principles in laying pipelines within the premises of a building.
5.16 Explain the general layout of water supply connections of buildings with mains and suggests a suitable interior water supply arrangements for single and multi-storied buildings as per I.S Code.
5.17 State the general precautions to be taken in plumbing work for buildings.
5.18 Describe the constructional details and uses of different fittings: ferrule, goose neck, stopcock.

**COURSE CONTENT**

1. **Environment and Ecology**
   1.1 Environment – Biosphere – Atmosphere – Acid rain, Green house effect, global warming – Ozone layer depletion.
   1.2 Renewable and non-renewable energy sources with examples.

2. **Introduction to Water Supply Scheme and Quantity of water**
   2.1 General importance of water supply.
   2.2 Development of Water supply.
   2.3 Need for protected Water supply.
   2.4 Flow chart of a typical water supply scheme.
   2.5 Total quantity of water for a town, per capita demand and factors affecting demand.
   2.6 Water requirements for domestic purposes, industrial use, fire fighting, commercial and institutional needs, public use.
   2.7 Variation in demand - peak demand – seasonal, daily and hourly variation.
   2.8 Forecasting population by arithmetical, geometrical and incremental increase methods-problems on above methods.

3. **Sources and Conveyance of Water**
   3.1 Surface source- Lakes, streams, rivers and impounded reservoirs.
   3.2 Underground sources-springs, wells, infiltration wells and galleries.
3.3 Yield from wells by constant pumping and recuperation tests. (No problems required)
3.4 Comparison of surface and subsurface sources.
3.5 Types of intakes:
   (i) Reservoir intake;
   (ii) River intake;
   (iii) Canal intake.
   (iv) Lake intake.
3.6 Conveyance of water-open channels, aqueduct pipes.
3.8 Pipe joints - spigot and socket joint, flange joint, expansion joint for C.I. Pipe, joints for concrete and asbestos cement pipes.
3.9 Pipe Laying and testing-Leak detection-prevention-rectification.

4. Quality and Purification of water
   4.1 Impurities of water - need for laboratory test – sampling- grab and composite sampling.
   4.2 Tests of water - physical, chemical and bacteriological tests – PH value of water.
   4.3 Standard quality for domestic use and industrial purposes.
   4.4 Flow diagram of different treatment units.
   4.5 Aeration - methods of aeration.
   4.6 Sedimentation - plain sedimentation and sedimentation with coagulation.
   4.7 Filtration - Construction and operation of slow sand rapid sand pressure filters.
   4.8 Disinfection of water - necessity and methods of chlorination, pre-chlorination, break point chlorination.
   4.9 Colour, taste and odour control

NOTE: No design of treatment units

5. Distribution system and water supply arrangements in a Building
   5.1 General requirements, systems of distribution - gravity system, combined system, direct pumping.
   5.2 Methods of supply - Intermittent and continuous.
   5.3 Storage - underground and overhead-service reservoirs - necessity and accessories.
   5.4 Types of layout - dead end, grid, radial and ring system their merits and demerits and their suitability.
   5.5 Location and functioning of:
      (i) Sluice valves.
      (ii) Check valves or reflux valves.
      (iii) Air valves.
      (iv) Drain valves or blow-off valves
      (v) Scour valves.
      (vi) Fire Hydrants.
      (vii) Water meters.
   5.6 Water supply arrangements in building:
      Definition of terms; water main, service pipe, communication pipe,
supply pipe, distribution pipe, air gap.

5.7 General lay out of water supply arrangement for single and multi-storeyed buildings as per I.S Code of practice-general principles and precautions in laying pipelines within the premises of a building.

5.8 Connections from water main to building with sketch.

5.9 Water supply fittings, their description and uses - stopcock, ferrule, goose neck etc.

REFERENCE

1. Environmental Engineering – G.S. Birdie
2. Elements of Public Health engineering – K.N. Duggal
3. Environmental Engineering – Baljeet Kapoor

QUANTITY SURVEYING II

<table>
<thead>
<tr>
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Time Schedule

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<td>Estimation of quantity of steel in RCC elements</td>
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<td>26</td>
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</table>
OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Prepare the estimate for RCC Structural elements:
   1.1 Explain types of staircases:
       a) Dog legged staircase
       b) Open well staircase
   1.2 Prepare detailed estimates of Dog legged staircase and Open well staircase.

2.0 Prepare the estimates for steel reinforcement for different R.C.C elements:
   2.1 State the different methods of estimation of steel required for R C C work involved in a building
   2.2 Explain the different methods of estimation of steel required for R C C work involved in a building
   2.3 Explain covers for RCC items as per IS 456 : 2000
   2.4 Distinguish between straight bars and cranked bars used in simply supported beams
   2.5 Distinguish between main reinforcement and distribution reinforcement used in RCC slabs
   2.6 Computes the quantity of steel reinforcement for different elements of R.C.C Works in building by preparing a bar bending schedule

3.0 Understands the Analysis of Rates and Abstract estimations:
   3.1 Define analysis of rates
   3.2 Explain the purpose of analysis of rates
   3.3 Explain different terms involved in rate analysis:
       a) Standard data book
       b) Standard schedule of rates
       c) Standard data sheet
   3.4 Explain cost of material at source
   3.5 Explain cost of material at site
   3.6 Explain terms:
       a) Blasting charges
       b) Seinorage charges
       c) Cess charges
       d) Stacking charges
       e) Water charges
       f) Crushing charges
       g) Lead charges
   3.7 Compute rate of an item of work
   3.8 Explain different type of labour wages as per latest SSR
   3.9 Define lead statement
   3.10 Prepare the format for Lead Statement
   3.11 Prepare Lead Statement and data for different items of work

Total: 75 110 10 08
3.12 Prepare the unit rates for finished items of works using standard data and SSR
3.13 Tabulate the material requirements of mortars and concrete of different proportions
3.14 Prepare abstract estimate for:
   a) Single bedroom building (1 BHK)
   b) Two bedroom building with verandah (2 BHK)
   c) Three bedroom building (3 BHK)

4.0 Prepare detailed estimates of roads and culverts:
4.1 Prepare a detailed estimate for different types of roads and culverts
4.2 State the items involved in the abstract estimates of roads and culverts

5.0 Prepare the detailed estimates of irrigation and public health engineering structures:
5.1 Prepare a detailed estimate for:
   a) Open well
   b) R.C.C. overhead tank
   c) Septic tank with soak pit / dispersion trench
   d) Tank sluice with tower head
5.2 State the items to be included in the abstract estimates of above structures

COURSE CONTENT

1.0 Detailed estimate of RCC elements:
   R C C Doglegged – Open well stairs

2.0 Estimation of quantities of steel in R C C elements:
   a) Simply supported singly reinforced R C C beams / Lintel
   b) Simply supported one- way slab
   c) R C C column with square footing
   d) Preparation of Bar bending schedule for above

3.0 Analysis of Rates and Abstract Estimates:
   a) Cost of materials at source and at site
   b) Standard Schedule of Rates of different materials in buildings works
   c) Types of labour – Wages as per S S R
   d) Lead and Lift – Preparation of Lead Statement
   e) Data Sheets – Standard data for materials and labour components for different items of work
   f) Preparation of unit rates for finished items of works using Standard data and S S R
   g) Methods of calculating quantities of ingredients of various proportions of cement concrete.
   h) Provisions for different building services and other over head charges
   i) Prepare abstract estimate for:
      i) Single bedroom building (1 BHK)
      ii) Two bedroom building with verandah (2 BHK)
      iii) Three bedroom building (3 BHK)
4.0 Detailed Estimates of Roads and Culverts:
   Gravel Road
   a) Water bound macadam road
   b) Surface dressing with bitumen
   c) Cement concrete road
   d) Pipe culvert
   e) R C C slab culvert with i) straight returns and ii) splayed wing walls
   f) Different items in abstract estimate (Labour charges, Traffic diversion etc)

5.0 Detailed Estimates of Irrigation and Public Health Engineering works:
   a) Open well with masonry staining
   b) R C C over head tank
   c) Septic tank with soak pit / dispersion trench
   d) Tank sluice with tower head.
   e) Different items to be included in the abstract estimates of the above

References
1. Estimating and Costing - B.N. Dutta
2. Estimating and Costing - S. C. Rangawala

IRRIGATION ENGINEERING

Subject Title : Irrigation Engineering
Subject Code : CE-504
Periods/Week : 05
Periods/Semester : 75

TIME SCHEDULE

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<th>Short Type</th>
<th>Essay Type</th>
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<td>1.</td>
<td>Nature and scope of Irrigation Engineering</td>
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<td>13</td>
<td>01</td>
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<td>2.</td>
<td>Elements of Hydrology</td>
<td>5</td>
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<td>Head works</td>
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<td>23</td>
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<td>Gravity dams and Earth dams</td>
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<td>Soil Erosion, Water logging and River Training works</td>
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<td>Water Management</td>
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<td>Watershed Management</td>
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OBJECTIVES
After completion of the subject, the student shall be able to
1.0 Understand the Nature and scope of Irrigation
1.1 Define Irrigation
1.2 Understand the necessity of irrigation.
1.3 List advantages and disadvantages of irrigation.
1.4 State different types of irrigation
1.5 Explain Perennial Irrigation
1.6 Explain Inundation Irrigation
1.7 Distinguish between
   (a) Perennial and inundation irrigation.
   (b) Flow and Lift irrigation.
   (c) Storage and Direct irrigation.
1.8 State Principal crops in India and their seasons
1.9 Explain Kharif crops
1.10 Explain Rabi Crops
1.11 Define the terms Duty, Delta, Base period, crop period
1.12 Explain different methods of expressing duty
1.13 State the relationship between duty and delta.
1.14 Explain the factors affecting duty
1.15 State the requirements for precise statement of duty
1.16 State the duty figures for principal crops
1.17 Solve simple problems on duty

2.0 Understand the basic concepts of Hydrology
2.1 Explain the term Precipitation
2.2 State different types of rain gauges
2.3 Describe Simon’s rain gauge
2.4 Explain the method of measurement of rainfall using Simon’s Rain gauge
2.5 Describe Float type automatic recording rain gauge
2.6 Explain method of measurement of rainfall using float type automatic rain gauge
2.7 Explain precautions in setting and maintenance of rain gauges
2.8 State uses of rain fall records
2.9 Describe Hydrological cycle
2.10 Explain method of average annual rainfall of an area by Theisson’s Polygon method
2.11 Solve the problem on calculation of average annual rainfall by Theisson’s Polygon method
2.12 Define terms Catchment, intercepted catchment, free catchment and combined catchment area
2.13 State the characteristics of good, average and bad catchments
2.14 Explain the term Run-off
2.15 Explain factors affecting runoff
2.16 Understand nature of catchment and runoff coefficient
2.17 Explain methods of estimating runoff using empirical formulae
2.18 Solve the problems on estimating run-off
2.19 Understand the term maximum flood discharge
2.20 Explain the methods of determining maximum flood discharge from rain fall records
2.21 State Ryve’s and Dicken’s Formulae
2.22 Understand HFL marks and gauge reading
2.23 Solve simple problems on estimating maximum flood discharge
2.24 Explain River gauging
2.25 Lists the factors for selecting suitable site for a gauging station
3.0 Understand head works for a diversion scheme and protective works for resisting percolation.
3.1 State the classification of head works
3.2 State the suitability of different type of head works under different conditions
3.3 State the factors for selecting suitable site for diversion head works
3.4 Describe with sketch the component parts of Diversion works.
3.5 Describe with sketch the component parts of a weir
3.6 Distinguish between barrages and Weirs
3.7 Describe head regulator with sketch
3.8 Describe scouring sluice with sketch
3.9 Describe flood banks and other protective works
3.10 Define the terms: Percolation, percolation gradient, uplift & scour.
3.11 Explain percolation gradient
3.12 Explain uplift pressure
3.13 Explain the effects of percolation on irrigation works

4.0 Understand basic ideas about reservoirs, gravity dams and Earth dams.
4.1 Distinguish between Rigid dams and Non-rigid dams
4.2 State factors influencing selection of site for reservoirs and dams.
4.3 Define the terms: Full reservoir level. Maximum water level, top bund level, dead storage, lives storage, free board, gravity dam, spillway.
4.4 Explain the causes of failure of gravity dams and their remedies.
4.5 Distinguish between low and high dams.
4.6 Draw the elementary profile of a gravity dam for a given height
4.7 Draw the practical profile of a low dam.
4.8 Explain uplift pressure
4.9 Explain necessity of drainage galleries with sketches
4.10 Explain construction and contraction joints with sketches
4.11 State need and types of grouting of foundations
4.12 Explain the method of grouting of foundations in gravity dams
4.13 State different types of spillways and their suitability and draw sketches
4.14 State the situations in which earth dams are suitable
4.15 State the three types of earth dams with sketches of typical cross sections
4.16 Explain causes of failure of earthen dams and their precautions
4.17 Explain the terms saturation gradient, phreatic line with sketches
4.18 Briefly explain drainage arrangements in earth dams with a neat sketch
4.19 State the method of constructing rolled fill earth dams and their maintenance.
4.20 Explain breach filling in earthen dams
4.21 Briefly explain the maintenance of earth dams

5.0 Understand basic ideas about canals & cross masonry works
5.1 State classifications of canals.
5.2 State the different methods of canal alignment and the situations in which each is suitable.
5.3 Sketches typical cross sections of canals in cutting, embankment and partial cutting.
5.4 Explain balanced depth of cutting and its necessity
5.5 State the necessity of canal lining
5.6 State advantages and disadvantages of canal linings
5.7 Explain different types of canal linings
5.8 Explain the maintenance required for canals and their regulation
5.9 Explain Lacey’s regime theory and Kennedy’s silt theory (only explanation of formulae) (No problems)
5.10 Compare Lacey’s and Kennedy’s silt theories
5.11 State different types of cross masonry works (cross regulator, drainage & Communication) and their objectives.
5.12 State necessity of cross drainage works
5.13 Describe with sketches aqueduct, super passage, under tunnel, siphon, level crossing & inlet and outlet

6.0 Understand the soil erosion, water logging and River training works
6.1 Explain terms: Soil erosion, reclamation, and water logging.
6.2 State causes of soil erosion
6.3 State ill effects of soil erosion
6.4 Explain various methods of prevention of soil erosion.
6.5 State causes of water logging
6.3 State ill effects of water logging
6.4 Explain various methods of prevention of water logging
6.5 State methods of land reclamation.
6.6 State different stages of flow of rivers
6.7 Explain characteristics of Delta Rivers
6.8 Explain term meandering of river
6.9 State objectives of river training works
6.10 Explain various types of groynes and bell’s bunds with sketches

7.0 Understand the principles of water management.
7.1 State soil-water plant relationship.
7.2 Briefly describe various irrigation methods-Broader irrigation, check basin irrigation, furrow irrigation, sprinkler irrigation and drip irrigation
7.3 Explain on farm development
7.4 Briefly describe warabandi system, water user associations
7.5 State the duties of water user associations

8.0 Understand the basic ideas about watershed management
8.1 Explain the concept of Water shed and water shed management
8.2 State the necessity of watershed management
8.3 List the objectives of watershed management
8.4 State need for watershed development in India
8.5 Briefly describe different approaches to water shed management
8.6 Briefly explain water harvesting
8.7 Explain methods of rain water harvesting and catchment harvesting
8.8 Briefly explain soil moisture conservation methods
8.9 Explain method water harvesting through check dams
8.10 Explain different methods of artificial recharge of ground water
8.11 Explain artificial recharges of ground water using percolation tanks

COURSE CONTENT

1. Nature and scope of Irrigation Engineering
   a) Definitions-necessity of irrigation-advantages and disadvantages-Perennial and Inundation irrigation-Flow and Lift irrigation-Direct and Storage irrigation.
   b) Principal crops-Kharif and Rabi crops-Dry and wet crops.
   c) Definition of duty, delta, base period, and crop period, Duty-different methods of expressing duty-base period-relationship between duty and delta- factors
affecting duty – Requirements for precise statement of duty - Duty figures for principal crops-simple problems on duty.

2. **Elements of Hydrology**
   a) Precipitation – Types of rain gauges – Simon’s rain gauge - Float type automatic recording gauge – precautions in setting and maintenance – rain fall records – Hydrological cycle-average annual rainfall of an area – Theissen’s polygon method.
   b) Catchment basin in catchment area - Free catchment - combined catchment - Intercepted catchment – Run- off - Factors affecting run-off - Nature of catchment, run off coefficient - Methods of estimating run off Empirical formulae -
   c) Maximum flood discharge - Methods of determining maximum flood discharge from rainfall records, Ryve’s and Dicken’s formulae, H.F.L Marks, Gauge reading – Simple problems on M.F.D.
   d) River gauging – Importance – Site selection for river gauging

3. **Head Works**
   a) Classification of head works-storage and diversion, head works - their suitability under different conditions-suitable site for diversion works - general layout of diversion works-brief description of component parts of diversion works, brief description of component parts of a weir.
   b) Barrages and Weirs.
   c) Head Regulator-scouring sluice-flood banks and other protective works.
   d) Percolation-Percolation gradient-uplift pressures-effect of percolation on irrigation works.

4. **Gravity dams and Earth dams**
   a) Dams-rigid and non-rigid dams - main gravity dams-failures of gravity dams and remedial measures - elementary profile – limiting height of dam-low dam and high dam - free board and top width – Practical profiles of low dam - uplift pressure - drainage gallery - Contraction joints - grouting of foundations - spillways

5. **Distribution works**
   a) Canals-classification-different methods of canal alignment-typical cross section of canal in cutting embankment, partial cutting and embankment – Berms - standard dimensions - balancing depth of cutting-canal lining-necessity - types –maintenance of canals.
   b) Lacey’s regime Silt Theory and Kennedy’s Silt Theory(only explanation of formulae)-Comparison of two theories (No problems)

6. **Soil erosion, Water logging and River Training works**
b) Different stages of flow of rivers-characteristics of Delta Rivers - Meandering - Object of river training - River training works- List out the various types of groynes and Bell’s bunds.

7. **Water management**
   Soil-water plant relationship-Irrigation methods-Broader Irrigation, check basin irrigation-Furrow Irrigation-Sprinkler irrigation-Drip irrigation – farm development, water user associations & Warabandi system.

8. **Watershed Management**
   a) Introduction - Concept of Watershed Management – Objectives of watershed Management – Need for watershed development in India – Integrated and multidisciplinary approach for water shed management.

**REFERENCES**

1. Irrigation Engineering by B.C Punmia
2. Irrigation Engineering and Water power Engineering by Birdie.
3. Irrigation Engineering by S.K.Garg
4. Irrigation Engineering by Basak-TMH

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**PROJECT MANAGEMENT FOR CONSTRUCTION**

**Subject Title**: Project Management for Construction

**Subject Code**: CE-505

**Periods/ week**: 04

**Periods/Semester**: 60

**TIME SCHEDULE**

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OBJECTIVES
After completion of the subject, the student shall be able to

1.0 Knows the importance of project management
   1.1. Defines Management.
   1.2. States the functions of Management.
   1.3. States the need for scientific Management of projects.
   1.4. Describes about the fields level management.
   1.5. Describes the sequencing of work

2.0 Understands the importance of Organizational Aspects
   2.1. Gives the organizational structure of any Engineering department (Government).
   2.2. Lists the duties of different officers of an Engineering department.
   2.3. Defines preliminary estimate, detailed estimate, administrative approval and technical sanction.
   2.4. States the limit of powers of sanction by various officers in an Engineering Department (Government).
   2.5. Gives the Organizational structure of a public sector construction company.
   2.6. Compares the Head quarters versus Regional and Project Management.
   2.7. Lists the duties of Chief Engineer in a construction company.
   2.8. Lists the duties of a Resident Engineer.

3.0 Understands the importance of Organizational Aspects
   3.1. Defines CPM and PERT.
   3.2. States the advantages of CPM and PERT.
   3.3. Explains the use of bar chart and its limitations
   3.4. Defines: Network, activity, event, duration, dummy activity, EST,
   3.5. EFT, LST, LFT, total float, free float, critical path.
   3.6. Prepares network diagram using basic rules of network formation.
   3.7. Calculates time on CPM network identifying critical activities, critical path, free float and total float.
   3.8. States the limitations of CPM.
   3.9. Distinguishes between CPM and PERT.

4.0 Understands different contract, Tendering systems and Arbitration.
   4.1. Defines contract
   4.2. States the contents of a contract document.
   4.3. Explains different contract systems available for construction works.
   4.4. Lists the merits and limitations of each of the contract systems.
   4.5. Lists the general conditions of contract for a civil engineering- construction project.
   4.6. Defines tender.
   4.7. Explains the need for calling of tenders.
   4.8. Lists the steps involved in fixing up agency through tender system.
4.9. Drafts a tender notice for a work
4.11. Explains the need of earnest money and security deposits.
4.13. Explains the method of selecting a contractor from the tenders.
4.15. Defines dispute and arbitration.
4.16. Explains the scope for disputes in a construction industry.
4.17. States the need for arbitration.
4.18. Lists the qualifications of an arbitrator.
4.19. Lists the advantages of arbitration.

5.0 **Understands the principles of management of Resources like Materials, Plant and Equipments and Money**
5.1. Explains the scope of materials management.
5.2. Classifies the common building materials based on the procurement.
5.3. Explain the different Stages of materials management.
5.4. Explains the points to be observed in the storage of perishable and non-perishable store materials.
5.5. Explains the terms indent, invoice & bin card.
5.6. Explains the importance of verification of stores.
5.7. Explains the need for mechanization.
5.8. Explains the need for optimum utilization of plant and equipment.
5.9. Explains the financial impact of mechanization.
5.10. Explains about the preventive maintenance of plant and equipment.
5.11. Explains the importance of training of operators.
5.12. Explains the need for overhauling or replacement.
5.13. Explains the requirements of centering, shuttering and scaffolding
5.14. States the importance of finance as a resource.
5.15. States the purposes of cost control.
5.16. Explains the different stages at which cost control can be achieved.
5.17. Explains the financial control at head office level and site level.

6.0 **Understands the role and characteristics of an entrepreneur.**
6.1. Defines the words entrepreneur, entrepreneurship.
6.2. Outlines the concepts of entrepreneurship.
6.3. States the role of entrepreneur in economic development.
6.4. Lists the characteristics of an entrepreneur.
6.5. Evaluates the risks and rewards of an entrepreneur.
6.6. States the role of financial institutions in entrepreneurial development.

7.0 **Understands the role of Human relations and professional ethics in construction Industry.**
7.1. State role of Human relations and performance in organization.
7.2. State the role of Interpersonal relationship for effective work culture.

**COURSE CONTENT**

1. **Introduction**
   Definition and concept of management – need for scientific management of projects – need for attitudinal change – Scope and characteristics of construction Industry.
2. Organizational Aspects

Public sector organizations: Organizational structure of a construction company – Head quarters versus Regional and Project Management – Duties of Chief Engineer – preparation of bids – duties of Resident Engineer.

3. Management Tools
Different Management Tools – Gantt Bar chart, modified Gantt bar chart – Limitations of bar charts – Introduction CPM and PERT – advantages of CPM and PERT – terms used in CPM – formation of network – Basic rules – Problems on determination of critical path – limitations of CPM – comparison of CPM and PERT.

4. Contracts, Tenders and Arbitration


5. Management of Resources in Construction Industry


6. Entrepreneurship
Entrepreneur – concept, definition, role, expectation – characteristics of entrepreneur – risk and rewards of an entrepreneur – role of financial institution in entrepreneurial development.

7. Human Relations and Professional Ethics
Human relations and performance in organization – Understand self and others for effective behavior – Interpersonal relationship for effective work culture – Need for professional ethics.
REFERENCE

   Oxford & IBH Publishing Co. Pvt., Ltd.,
3. Construction Planning and Management – U.K. Shrivastava
   Tata Mc. Grao Hill Publishing Company Ltd.

COMPUTER APPLICATIONS FOR PROJECT MANAGEMENT

Subject Title : COMPUTER APPLICATIONS FOR PROJECT MANAGEMENT
Subject Code : CE - 506
Periods/Week : 04
Periods/semester : 60

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to Project Management Software and Building Services soft wares.</td>
<td>04</td>
</tr>
<tr>
<td>2.</td>
<td>Practice on Project Management software</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>Practice on Software for Building Services</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>Preparation of Structural and Irrigation Drawings using CAD</td>
<td>24</td>
</tr>
</tbody>
</table>
OBJECTIVES
After completion of the subject, the student shall be able to

1.0 Understanding Project Management Software and Building Services softwares
   1.1 States the features and applications of Project management software.
   1.2 States the features of Building services software.

2.0 Practices Project Management software
   2.1 Understands various menus available in MS-Project.
   2.2 Understands input data.
   2.3 Understands various commands to execute the given input data.
   2.4 Prepares schedules for resource allocation.
   2.5 Prepares networks for execution of projects.

3.0 Practice on Software for Building Services
   3.1 Understands various menus available in 4M-IDEA-BIM software.
   3.2 Prepares Layout of HVAC design for a given multistoried building plan using 4M-IDEA software.
   3.3 Prepares Layout of water supply and sewerage design for a given multi storied building using 4M-IDEA software.
   3.4 Prepares Layout of Electrical design for a given multistoried building plan using 4M-IDEA software.
   3.5 Prepares Layout of Lift design for a given multistoried building plan using 4M-IDEA software.
   3.6 Prepares Layout of fire fighting design for a given multistoried building plan using 4M-IDEA software.

4.0 Prepares Structural and Irrigation Drawings using CAD
   4.1 Prepares R.C.C Drawings
      4.1.1. Singly reinforced Rectangular beam
      4.1.2. T-beam
      4.1.3. Slab
      4.1.4. Column with Footing.
   4.2 Prepares Structural Steel Drawings
      4.2.1. Built-up beams
4.2.2. Beam-column connection
4.2.3. Slab base and Gusseted base.

4.3 Prepares Irrigation Drawings
4.3.1. Earthen Bunds
4.3.2. Slab Culvert
4.3.3. Pipe Culvert.
## KEY Competencies to be achieved by the students

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Experiment Title</th>
<th>Key Competency</th>
</tr>
</thead>
</table>
| 1.    | **Introduction to Project Management Software and Building Services softwares.** | • Learns the applications of Project management software.  
• Learns the applications of Building services software |
| 2     | **Practice on Project Management software**                           | • Learns various menus available in MS-Project  
• Learns inputting data  
• Learns various commands to execute the given input data  
• Prepares schedules for resource allocation  
• Prepares networks for execution of projects |
| 3     | **Practice on Software for Building Services**                        | • Learns various menus available in 4M-IDEA-BIM software.  
• Prepares Layout of HVAC design for a given multistoried building plan using 4M-IDEA software.  
• Prepares Layout of water supply and sewerage design for a given multi storied building using 4M-IDEA software.  
• Prepares Layout of Electrical design for a given multistoried building plan using 4M-IDEA software.  
• Prepares Layout of Lift design for a given multistoried building plan using 4M-IDEA software.  
• Prepares Layout of fire fighting design for a given multistoried building plan using 4M-IDEA software |
| 4     | **Preparation of Structural and Irrigation Drawings using CAD**       | • Draws R.C.C  
• Draws Structural Steel Drawings  
• Draws Irrigation Drawings |
COURSE CONTENT

1.0 Introduction to Project Management and Building Service softwares.
   a) Importance of Project Management software and Building Services Software.
   b) Available Project Management softwares – MS-project, Primavera Project Planner.
   c) Features of MS-Project software.
   d) Available Building services softwares – 4M IDEA BIM (Building Information Modelling) software.
   e) Features of 4M IDEA BIM (Building Information Modelling) software.

2.0 Practice on Project Management software.
   a) Study various Menus available in MS-Project.
   b) Identify various activities for a given project.
   c) Input data required for the given project.
   d) Prepare schedules using MS-Project for resources like men, material, machinery, money.
   e) Calculate duration of project and Critical Path
   f) Generate various reports for the supervision of the project.

3.0 Practice on Software for Building Services
   a) Components of Building information Model (BIM) like 4M software.
      i. For Heat, Ventilation and Air conditioning design
      ii. For Water supply and sewage design
      iii. For Electrical design
      iv. For Design of lifts
      v. For design of Fire fighting System
      vi. For Gas supply pipes design
   b) Prepare Layout of HVAC design for a given multistoried building plan.
   c) Prepare Layout of water supply and sewerage design for a given multistoried building plan.
   d) Prepare Layout of Electrical design for a given multistoried building plan.
   e) Prepare Layout of Lift design for a given multistoried building plan.
   f) Prepare Layout of fire fighting design for a given multistoried building plan.

4.0 Preparation of Structural and Irrigation Drawings using CAD
   a) R.C.C Drawings - Singly reinforced Rectangular beam – T-beam – Slab – Column with Footing.
   b) Structural Steel Drawings – Built-up beams – Beam-column connection – Slab base and Gusseted base.
   c) Irrigation Drawings – Earthen Bunds – Slab Culvert – Pipe Culvert.
CIVIL ENGINEERING DRAWING – II

Subject Title : Civil Engineering Drawing - II
Subject Code : CE - 507
Periods/Week : 06
Periods/semester : 90

TIME SCHEDULE

<table>
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<tr>
<th>S.No</th>
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<th>No. of Periods</th>
<th>Weightage of Marks</th>
<th>Short Type</th>
<th>Essay Type</th>
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<tbody>
<tr>
<td>1.</td>
<td>Culverts</td>
<td>15</td>
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<tr>
<td>2.</td>
<td>Bridges</td>
<td>15</td>
<td>12</td>
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<td>01</td>
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<td>(25marks)</td>
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<tr>
<td>3.</td>
<td>Public health engineering drawings</td>
<td>12</td>
<td>16</td>
<td>1</td>
<td>01</td>
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<td>(15marks)</td>
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<tr>
<td>4.</td>
<td>Irrigation drawings</td>
<td>48</td>
<td>20</td>
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<td>Total</td>
<td>90</td>
<td>60</td>
<td>05</td>
<td>02</td>
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</table>

Note: All questions are to be answered. Part-A 5X4=20 marks & part-B 25+15=40 marks

OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Draw different views of culverts.
   1.1 Draw the plan, cross sectional elevation and longitudinal sectional elevation of Pipe culvert, R.C.C –slab culvert and identify the component parts from the given set of specifications.

2.0. Draw different views of T. Beam bridge
   2.1 Label the component parts of a given R.C.C. T-beam bridge.
   2.2 Draw the sectional elevation, plan and cross section of Two span R.C.C T-beam bridge from the set of given specifications.

3.0 Draw the component parts of Public health Engineering works
   3.1 Draw the sectional elevation, plan and cross section of public health Engineering works.

4.0 Draw the different views of irrigation Engineering structure
   4.1 Draw the sectional elevation, plan and cross section of different Irrigation Engineering structures.
COURSE CONTENT

1. **Simple Culvert**
   - Draw the plan, cross-sectional elevation and longitudinal sectional elevation of
     1. Pipe culvert (Single Pipe)
     2. R.C.C slab culvert with square returns.
     3. R.C.C slab culvert with splayed wings

2. **Bridges**
   - Two-Span R.C.C T-beam bridge with square return walls.
   - Two-Span R.C.C T-beam bridge with splayed wing walls and Return walls.
   - Details of bearings used in steel bridges, R.C.C. bridges and P.S.C. bridges (sketches not to scale).

3. **Public health engineering drawings**
   - Septic tank with details of connection to a dispersion trench/soak pit
   - R.C.C overhead rectangular tank (four columns with accessories).

4. **Irrigation engineering drawings**
   - Earthen bunds — Three types.
     a) Homogeneous type
     b) Zoned embankment type
     c) Diaphragm type
   - Tank surplus weir with splayed wing walls.
   - Canal drop (notch type)
   - Head sluice (Head wall type)
   - Tank sluice with tower head.
   - Canal regulator

**REFERENCE**
2. Civil Engineering Drawing-II by Chakraborty
# CONSTRUCTION TECHNOLOGY PRACTICE

**Subject Title**: Construction Technology Practice  
**Subject Code**: CE-508  
**Periods/ Week**: 03  
**Periods/Semester**: 45

## TIME SCHEDULE

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>List of Experiments</th>
<th>No. of periods</th>
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<tbody>
<tr>
<td><strong>Tests on Road Aggregate</strong></td>
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<tr>
<td>1</td>
<td>Specific Gravity of fine and coarse aggregate</td>
<td></td>
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<tr>
<td>2</td>
<td>Impact value of coarse aggregate</td>
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<tr>
<td>3</td>
<td>Crushing value of coarse aggregate</td>
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<tr>
<td>4</td>
<td>Abrasion value of coarse aggregate</td>
<td></td>
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<tr>
<td>5</td>
<td>Flakiness Index of coarse aggregate</td>
<td></td>
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<tr>
<td>6</td>
<td>Elongation Index of coarse aggregate</td>
<td></td>
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<tr>
<td><strong>Tests on Concrete</strong></td>
<td></td>
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<tr>
<td>7</td>
<td>Slump test on concrete</td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td>Study the changes in workability by adding cement paste to poorly workable concrete</td>
<td></td>
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<tr>
<td>(b)</td>
<td>Study the changes in workability by adding dry cement to poorly workable concrete</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Compaction factor test on concrete</td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td>Study the changes in compactor of a poorly workable concrete by admixtures</td>
<td></td>
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<tr>
<td>(b)</td>
<td>Study the methods of enhancing workability of concrete without using any admixtures</td>
<td></td>
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<tr>
<td>9</td>
<td>Casting of Cement concrete cubes</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Testing of cement concrete cubes for compression</td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td>Compare the compressive strengths of concrete cubes made and cured with potable water and concrete cubes made and cured with non-potable water</td>
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<tr>
<td>(b)</td>
<td>Compare the compressive strengths of concrete cubes of concrete made with gap graded coarse aggregate and that made with well graded coarse aggregate</td>
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<tr>
<td>11</td>
<td>Split Tensile Strength of concrete</td>
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<tr>
<td></td>
<td>OBJECTIVES</td>
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<tr>
<td></td>
<td>After completion of the subject, the student shall be able to</td>
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<tr>
<td>1.0</td>
<td>Determine suitability of given sample of aggregate for road construction</td>
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<tr>
<td></td>
<td>Specific Gravity of fine and coarse aggregate</td>
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</tr>
<tr>
<td>1.1</td>
<td>Study the importance of specific gravity of fine and coarse aggregate</td>
<td></td>
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<tr>
<td>1.2</td>
<td>State the range of specific gravity values for various naturally available fine and coarse aggregate</td>
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<tr>
<td>1.3</td>
<td>Use the apparatus required for conducting specific gravity test on both fine and coarse aggregate</td>
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<tr>
<td>1.4</td>
<td>Perform the specific gravity tests for both fine and coarse aggregate</td>
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<tr>
<td></td>
<td>Impact value of coarse aggregate</td>
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<tr>
<td>1.5</td>
<td>Study the significance of impact value of aggregate used for road construction</td>
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<tr>
<td>1.6</td>
<td>State the standards on impact value of aggregate used for various civil engineering works as per IS-383</td>
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<tr>
<td>1.7</td>
<td>Use the apparatus required for conducting impact test on aggregate</td>
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<tr>
<td>1.8</td>
<td>State the procedure for preparing the sample and no. of samples required for the given work</td>
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<td>1.9</td>
<td>Explain the procedure for conducting impact test on aggregate</td>
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<tr>
<td>1.10</td>
<td>Perform impact test on given sample of coarse aggregate</td>
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<tr>
<td>1.11</td>
<td>Draw inferences by conducting impact test on different types of natural aggregate</td>
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<tr>
<td></td>
<td>Crushing value of coarse aggregate</td>
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<td>1.12</td>
<td>Study the significance of crushing value of aggregate used for various civil engineering works</td>
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<tr>
<td>1.13</td>
<td>State the standards on crushing value of aggregate used for various civil engineering works as per IS-383</td>
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<tr>
<td>1.14</td>
<td>Use the apparatus required for conducting crushing test on aggregate</td>
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</table>
1.15 State the procedure for preparing the sample and no.of samples required for the given work
1.16 Explain the procedure for conducting crushing test on aggregate
1.17 Perform crushing test on given sample of coarse aggregate
1.18 Draw inferences by conducting crushing test on different types of natural aggregate

**Abrasion value of coarse aggregate**
1.19 Study the significance of abrasion value of aggregate used for various civil engineering works
1.20 State the standards on abrasion value of aggregate used for various civil engineering works as per IS-383
1.21 Use the apparatus required for conducting abrasion test on aggregate
1.22 State the procedure for preparing the sample and no.of samples required for the given work
1.23 Explain the procedure for conducting abrasion test on aggregate
1.24 Perform abrasion test on given sample of coarse aggregate
1.25 Draw inferences by conducting abrasion test on different types of natural aggregate

**Flakiness Index of coarse aggregate**
1.26 Study the significance of flakiness index of aggregate on strength and workability properties of concrete
1.27 State the standards on flakiness index of aggregate
1.28 Use the apparatus required for conducting flakiness index of coarse aggregate
1.29 Explain the procedure for conducting the flakiness index test on coarse aggregate

**Elongation Index of coarse aggregate**
1.30 Study the significance of elongation Index of aggregate on strength and workability properties of concrete
1.31 State the standards on elongation Index of aggregate
1.32 Use the apparatus required for conducting elongation Index of coarse aggregate
1.33 Explain the procedure for conducting the elongation Index test on coarse aggregate
1.34 Determine suitability of fresh and hardened concrete for the given conditions of workability and strength
1.35 Study the importance of workability on strength properties of concrete
1.36 State various types of tests used for measuring the workability of fresh concrete
1.37 State standards on workability of concrete used for different places of construction

**Slump cone test**
2.0 Use apparatus required for conducting slump test
2.1 Explain the procedure for conducting slump test of workability
2.2 Perform slump test on the concrete made of given sample of ingredients
2.3 Draw inference from test results on slump test of workability of concrete made with coarse aggregate having different elongation index.
2.4 Draw inference from test results on slump test of workability of concrete made with coarse aggregate having different flakiness index.
2.5 Compare the slumps of concrete made with gap graded coarse aggregate and well graded coarse aggregate.
2.6 Study the changes in workability by adding cement paste to poorly workable concrete.
2.7 Study the changes in workability by adding dry cement to poorly workable concrete.

**Compaction factor test**

2.8 State the purpose of compaction of concrete.
2.9 Use apparatus required for conducting compaction factor test.
2.10 Explain the procedure for conducting compaction factor test of workability.
2.11 Perform compaction factor test on the concrete made of given sample of ingredients.
2.12 Draw inference from test results on compaction factor test of workability of concrete made with coarse aggregate having different elongation index values.
2.13 Draw inference from test results on compaction factor test of workability of concrete made with coarse aggregate having different flakiness index values.
2.14 Compare the compaction factors of concrete made with gap graded coarse aggregate and that made with well graded coarse aggregate.
2.15 Study the changes in compactor of a poorly workable concrete by admixtures.
2.16 Study the methods of enhancing workability of concrete without using any admixtures.

**Casting of Cement concrete cubes**

2.17 Study the purpose of casting of concrete cubes.
2.18 Use equipment required for casting of cement concrete cubes.
2.19 Explain the procedure for casting concrete cubes.
2.20 Cast the concrete cubes with given ingredients.

**Testing of cement concrete cubes for compression**

2.21 Study the importance of testing concrete cubes.
2.22 Use equipment required for conducting compression test concrete cubes.
2.23 State the precautions to be taken for testing of concrete cubes.
2.24 Explain the procedure for conducting compression test on concrete cubes.
2.25 Draw inference from test results on compressive strength of concrete cubes made with coarse aggregate having different elongation index values.
2.26 Draw inference from test results on compressive strength of concrete cubes made with coarse aggregate having different flakiness index values.
2.27 Compare the compressive strengths of concrete cubes of concrete made with gap graded coarse aggregate and that made with well graded coarse aggregate.
2.28 Compare the compressive strengths of concrete cubes made and cured with potable water and concrete cubes made and cured with non-potable water.

**Split Tensile Strength of concrete**
2.29 Study the importance of split tensile strength of concrete
2.30 Cast the concrete cylinders with given ingredients
2.31 Explain the procedure for conducting split tensile strength test on concrete cylinders
2.32 Perform split tensile strength test on concrete cylinder

Design mix of concrete proportion as per IS: 10262 - 2009

2.33 Study the various elements of design mix of concrete as per IS:10262-2009
2.34 Conduct tests to find specific gravity, bulk density and sieve analysis of aggregate for the preparation of design mix of concrete
2.35 Write the procedure for design mixing of concrete
2.36 Calculate the proportions of ingredients of concrete as per IS:10262-2009
2.37 Cast cubes of trail mixes to decide the proportion of concrete
2.38 Perform the compression tests on concrete cubes casted as per design mix

3.0 Understand the significance of various non-destructive tests on concrete

3.1 State the importance of non-destructive tests
3.2 State the apparatus/equipment required for the non-destructive tests
3.3 Explain the procedure for conducting non-destructive tests
3.4 Perform the non-destructive tests like Rebound hammer tests, ultrasonic tests on the given hardened concrete
3.5 Record the observations of tests
3.6 Draw the inferences from the test results

4.0 Determine various engineering properties of soils used for various Civil Engineering Activities

Sieve Analysis – Classification of soil

4.1 Study the classifications of various types of soils
4.2 Use apparatus required for conducting sieve analysis of soils
4.3 Explain the procedure for conducting sieve analysis of soils
4.4 Perform sieve analysis over a given soil sample

Atterberg Limits of Soil

4.5 Study the significance of atterberg limits of soil in civil engineering activities
4.6 Study atterberg limits of soils
4.7 Use apparatus required for conducting tests to determine atterberg limits of soil
4.8 Explain the procedure for conducting atterberg limits of soil
4.9 Perform tests to determine liquid limit, plastic limit, shrinkage limit and plasticity index of a given soil sample
4.10 Calculate the values of atterberg limits of given soil sample from the observations of tests
4.11 Classify given soil sample based on sieve analysis and atterberg limits

Field Density of soil (Sand Replacement Method)

4.12 Study the significance of field density of soil
4.13 Use the apparatus required for conducting field density of soil
4.14 Explain the procedure for conducting field density test on soil by sand replacement method
4.15 Perform field density test of soil by sand replacement method
**Proctor Compaction Test**

4.16 Study the significance of proctor compaction test
4.17 Use the apparatus required for conducting proctor's compaction test
4.18 Explain the procedure for conducting proctor compaction test
4.19 Perform proctor compaction test over given sample of soil
4.20 Compare the observations of tests conducted on different types of soils
4.21 Draw the graph for proctor's compaction test
4.22 Calculate the values OMC and MDD of given soil sample from the observations of test

**KEY Competencies to be achieved by the student**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Experiment Title</th>
<th>Key Competency</th>
</tr>
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</table>
| 1     | Specific Gravity of fine and coarse aggregate | • Taking weights of empty pycnometer, pycnometer with water and pycnometer with aggregate accurately  
• Record the observations accurately  
• Calculate the values correctly |
| 2     | Impact value of coarse aggregate              | • Preparation of sample correctly  
• Weighing the cup and aggregate accurately  
• Counting of strokes accurately  
• Weighing residue retained on 2.36 mm sieve correctly |
| 3     | Crushing value of coarse aggregate            | • Preparation of sample correctly  
• Weighing the mould and aggregate accurately  
• Applying the load at required rate and to the required period accurately  
• Weighing residue retained on 2.36 mm sieve correctly |
| 4     | Abrasion value of coarse aggregate            | • Weighing the aggregate accurately  
• Counting the required number of rotations correctly  
• Weighing residue retained on 1.70 mm sieve accurately |
| 5     | Flakiness Index of coarse aggregate           | • Arrangement of sieves in correct order  
• Weighing the aggregate passing through thickness gauge correctly |
<p>| | | |</p>
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<thead>
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</table>
| 6 | Elongation Index of coarse aggregate | • Arrangement of sieves in correct order  
   |   | • Weighing the aggregate retaining over length gauge correctly  |
| 7 | Slump cone test on concrete | • Weighing the material accurately  
   |   | • Apply required no.of tampings for each layer of concrete  
   |   | • Measuring the subsidence accurately  |
| 8 | Compaction factor test on concrete | • Weighing the material accurately  
   |   | • Weighing the mould and concrete accurately  
   |   | • Calculating the compactor factor correctly  |
| 9 | Casting of Cement concrete cubes | • Weighing the material accurately  
   |   | • Vibrating the concrete filled in moulds to the required time correctly  
   |   | • Curing the demoulded cubes to the required period  |
| 10 | Testing of cement concrete cubes for compression | • Applying the load at required rate correctly  
    |   | • Recording the load at FAILURE accurately  
    |   | • Calculating the compressive strength accurately  |
| 11 | Split Tensile Strength of concrete | • Applying the load at required rate correctly  
    |   | • Recording the load at FAILURE accurately  
    |   | • Calculating the split tensile strength accurately  |
| 12 | Design mix of concrete proportion | • Calculating the proportions of material correctly  
    |   | • Weighing the ingredients of concrete accurately as per design mix calculations  |
| 13 | Non-destructive tests on concrete | • Applying the load at required rate as per procedure correctly  
    |   | • Calculating the strength of hardened concrete from graphs accurately  |
| 14 | Sieve Analysis – Classification of soil | • Weighing of residue in each sieve accurately  
    |   | • Weighing of residue in each sieve accurately  |
| 15 | Field Density of soil(Sand Replacement Method) | • Calibration of apparatus correctly  
    |   | • Weighing the samples accurately  
    |   | • Calculating the density accurately  |
| 16 | Proctor Compaction Test | • Weighing the soil correctly  
• Measuring the water accurately  
• Applying required no.of blows of compaction accurately  
• Recording the observations correctly  
• Drawing graph correctly |

**COURSE CONTENT**

1. **Tests on Road aggregate**
   a. Specific Gravity of fine and coarse aggregate  
   b. Impact value of coarse aggregate  
   c. Crushing value of coarse aggregate  
   d. Abrasion value of coarse aggregate  
   e. Flakiness index of coarse aggregate  
   f. Elongation index of coarse aggregate

2. **Tests on concrete**
   a. Workability test by Slump Cone Test  
   b. Workability test by Compaction factor test  
   c. **Casting of Cement concrete cubes**  
   d. **Testing of Cement concrete cubes for compression**  
   e. Split tensile strength of concrete  
   f. Design mix of concrete proportion

3. **Non-destructive tests on concrete**
   a. Surface hardness test(Rebound hammer test)  
   b. Ultrasonic Test

4. **Tests on Soil**
   a. Sieve analysis-classification of soil.  
   b. Liquid limit and plastic limit  
   c. Field density of soil (sand replacement method)  
   d. Proctor Compaction Test

**REFERENCE**

2. Concrete Technology(5/E) – M.L. Gambhir-TMH  
# FIELD PRACTICES

**Subject Title**: Field Practices  
**Subject Code**: CE-509  
**Periods/Week**: 06  
**Periods/Semester**: 90

## TIME SCHEDULE

<table>
<thead>
<tr>
<th>S. No</th>
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<th>No. of Periods</th>
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<tbody>
<tr>
<td>1.</td>
<td>Marking for the earth work of a pillar</td>
<td>03</td>
</tr>
<tr>
<td>2.</td>
<td>Marking for the earth work for the junction of two walls</td>
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</tr>
<tr>
<td>3.</td>
<td>Marking the centre line of a one roomed building</td>
<td>03</td>
</tr>
<tr>
<td>4.</td>
<td>Marking for the earth work of a simple two roomed building</td>
<td>06</td>
</tr>
<tr>
<td>5.</td>
<td>Marking for the centre line of a one room in a residential building with reference to the given point using Total Station</td>
<td>06</td>
</tr>
<tr>
<td>6.</td>
<td>Preparation of cement mortar with specified mix proportion by manual mixing and volumetric proportioning.</td>
<td>06</td>
</tr>
<tr>
<td>7.</td>
<td>Construction of 230mm thick brick wall in English Bond at the corner of a Wall and check for horizontality and verticality.</td>
<td>06</td>
</tr>
<tr>
<td>8.</td>
<td>Supervisory skills of Plastering of a wall.</td>
<td>09</td>
</tr>
<tr>
<td>9.</td>
<td>Supervisory skills for construction of Cement Concrete Flooring.</td>
<td>06</td>
</tr>
<tr>
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<td>Supervisory skills of fixing of floor trap, gully trap and their connections to drain.</td>
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<td>Placement of reinforcement in an Isolated Column Footing with proper cover.</td>
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<td>Placement of reinforcement for sun shade (with specific attention of location).</td>
<td>06</td>
</tr>
<tr>
<td>14.</td>
<td>Placement of reinforcement for stairs spanning longitudinal</td>
<td>06</td>
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</tbody>
</table>
case (with specific attention at the junction of waist and landing slabs).

15. Placement of reinforcement for slab (with specific attention of chairs).

16. Placement of reinforcement for a Beam column junction (with specific attention to Earth quake resistance design).

Total

<table>
<thead>
<tr>
<th>SLILLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>After completion of the subject, the student shall be able to</td>
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</tbody>
</table>

1.0 **Marking for the earth work of a pillar**
   1.1 Note down the measurements of pillar at superstructure and measurements of earth work excavation.
   1.2 Mark the centre lines of pillar in either direction.
   1.3 Mark the size of pillar with reference to the centre lines.
   1.4 Mark the size by pouring the lime.

2.0 **Marking for the earth work of a junction of a wall**
   2.1 Read the width of walls at super structure from drawing.
   2.2 Mark the centre line of main walls from the markings on burjis.
   2.3 Mark the centre line of cross wall perpendicular to main wall with the help of wooden set square or by other means.
   2.4 Transfer the same by pouring the lime on the centre line.

3.0 **Marking the centre line of a one roomed building**
   3.1  Read the width of walls at super structure and width of earth work excavation from drawing.
   3.2  Mark the centre line of main wall from the markings on burjis.
   3.3  Mark the centre line of cross wall perpendicular to main wall with the help of wooden set square or by other means.
   3.4  Mark the width of walls with reference to centre lines of walls.
   3.5  Transfer the same by pouring the lime to proceed for excavation.
   3.6  Mark the width of excavation with the help of threads placed parallel to the centre line and at a distance equal to half the width of excavation on either side of centre line.
   3.7  Transfer the same by pouring lime to proceed for excavation.

4.0 **Marking for the earth work of a simple two roomed building**
   4.1 Prepare the centre line diagram from a given drawing.
   4.2 Note down width of earthwork excavation.
   4.3 Mark the centre lines on the ground with the help of plumb bob.
   4.4 Check the accuracy by measuring length of two diagonals and their equality.
4.5 Mark the width of excavation with the help of threads placed parallel to the centre line and at a distance equal to half the width of excavation on either side of centre line.

4.6 Transfer the same by pouring lime to proceed for excavation.

5.0 Marking for the centre line of a one room in a residential building with reference to the given point using Total Station

5.1 Place the total station at the point of known co-ordinates.

5.2 Perform temporary adjustments.

5.3 Key in the known co-ordinates of the point.

5.4 Place the target prism on the ground to locate the first corner point of known/calculated co-ordinate of centre line of the room.

5.5 Transfer the first corner point on to the ground.

5.6 Repeat the procedure to locate the second, third, fourth corner points of known co-ordinates and transfer the points on to the ground.

6.0 Preparation of cement mortar with specified mix proportion by manual mixing and volumetric proportioning

6.1 Note the mix proportion and take the respective quantities of cement and sand (volume of 1 bag of cement = 0.035 cubic meter).

6.2 Place the measured quantity of sand to a suitable stack on an impervious hard surface.

6.3 Spread the cement uniformly over the sand stack.

6.4 Dry mix both sand and cement thoroughly to a uniform colour.

6.5 Sprinkle sufficient quantity of water on the dry mix while thoroughly mixing the dry mortar, which can be used for 30 minutes.

6.6 Continue the mixing to bring the mortar to a stiff paste of working consistency.

7.0 Construction of 230mm thick brick wall in English Bond at the corner of a wall and check for horizontality and verticality

7.1 Soak the bricks in water and air dry before their use.

7.2 Prepare C.M of specified proportion and keep ready for use

7.3 Sketch the two threads perpendicular to each other at specified corner in line with the outer edges of wall.

7.4 Arrange the quion header in line with the two perpendicular threads

7.5 Arrange the queen closure adjacent to quoin header.

7.6 Continue one layer with headers on one face and stretchers on the perpendicular face to the true line.

7.7 Continue the next layer with stretchers on headers and headers on stretchers.

7.8 Check the verticality of the wall with the help of plumb bob and horizontality with the help of level tube for every three to four layers.

7.9 Place the bricks, with frog at the top.

7.10 Fill the vertical joint in each layer with mortar using trowel.

8.0 Supervisory skills of Plastering of a wall

8.1 Prepare the surface by raking the joints and brushing the efflorescence if any by brushing and scraping dust and loose mortar.
8.2 Remove efflorescence if any by brushing and scraping.
8.3 Wash the surface thoroughly with water and keep the surface wet before commencement of plastering.
8.4 Complete the ceiling plaster before commencement of wall plaster.
8.5 Fill all put log holes in advance of the plastering.
8.6 Start plastering from top and work down towards the floor.
8.7 Apply 15cm x 15cm plaster of specified thickness first, horizontally and vertically at not more than 2.0m intervals over the entire surface to serve as gauges.
8.8 Check the surfaces of gauges for truly in plane of the finished plaster surface by using a plumb bob.
8.9 Apply the mortar on the wall between the gauges with a trowel to a thickness slightly more than the specific thickness.
8.10 Use a wooden straight edge to bring to the true surface with small upward and sideways movement at a time reaching across the gauges.
8.11 Use trowel to obtain final finish surface as a smooth OR wooden float for sandy granular texture.
8.12 Avoid excessive use of trowel or over working the float.

9.0 Supervisory skills for construction of Cement Concrete Flooring

a. Base Concrete
9.1 Use cement concrete of specified mix
9.2 Provide base concrete with the slopes towards floor trap required for the flooring using tube level.
9.3 Provide a slope ranging from 1:48 to 1:60 for flooring in varandah, courtyard, kitchen and bath.
9.4 Provide a slope of 1:30 for floors in water closet portion.
9.5 Provide necessary drop of 6mm to 10mm in flooring in bath, water closet and kitchen near floor traps to avoid spread of water.

b. Finishing
9.6 Follow the finishing of the surface immediately after the cessation of beating.
9.7 Allow the surface till moisture disappears from it.
9.8 Use of dry cement or cement mortar to absorb excessive moisture not permitted.
9.9 Spread the thick slurry of fresh cement and water @ 2kg of cement over an area of 1 square metre of flooring, while flooring concrete is still green.
9.10 The cement slurry shall be properly processed and finished smooth.
9.11 Finish the edge of sunk floor rounded with C.M 1:2 and finish with a floating coat of neat cement.
9.12 Cure the surface for a minimum period of 10 days.
9.13 Lay the flooring in lavatories and bath rooms only after fixing of water closets and squatting pans and floor traps.
9.14 Plug the traps while laying and open after curing and cleaning.

10.0 Supervisory skills of fixing of floor trap, gully trap and their connections to drain.
10.1 Identify the Floor trap and Gully trap
10.2 Identify the location of fixing the floor trap and gully trap
10.3 Connect the floor trap to the drain pipe.
10.4 Fix the joint using proper filler and adhesive material such that the joint is water tight.
10.5 Fix gully trap on cement concrete foundation 65 mm x 65 mm and not less than 10 mm thick.
10.6 Prepare a mix of concrete 1:5:10 and jointing of gully outlet gully outlet to the branch drain is done.
10.7 Tarred gasket soaked in thick cement slurry shall first be placed round the spigot of the drain.
10.8 The remainder of the socket is filled with stiff mixture of cement mortar in the proportion of 1:1.

11.0 Placement of reinforcement for an Isolated Column Footing
11.1 The grill of column footing should be kept ready as per design data.
11.2 Mark the centre lines in both directions on levelling course / bedding concrete with the help of plumb bob from the string stretched over the burjis.
11.3 Mark centre of the outer reinforcing rods of footing in either direction.
11.4 Carefully place the grill such that centre line markings of outermost reinforcing rods are exactly above the centre lines marked on the bedding concrete.
11.5 Place the chairs/cover blocks of specified thickness below the bottom layer of reinforcing rods.
11.6 Exercise care for rectangular column footing while placing reinforcing mat such that bars in longer direction are at bottom.

12.0 Positioning of shuttering to the column reinforcement
12.1 Place the column reinforcement with chairs or cover blocks over the foundation mat.
12.2 Prepare the reinforcement as per the drawing.
12.3 Check for the verticality of column reinforcement with plumb bob.
12.4 Provide lateral support for the column reinforcement to keep them in position.
12.5 Prepare the shuttering and apply waste oil inside surface of the shuttering box and fastenings.
12.6 Place the shuttering box around the column and fix the fastenings.
12.7 Check for the verticality of shuttering with plumb bob.

13.0 Placement of reinforcement for sun shade (with specific attention of location)
13.1 Prepare the reinforcement as per design.
13.2 Prepare the centering for sun shade.
13.3 Place the grill for sun shade such that the main reinforcement is in the top zone leaving the cover.
13.4 Place the cement mortar cover blocks or chairs of specified height below the main reinforcement to have prescribed cover above the reinforcement.
13.5 Observe for sufficient length of anchorage of main reinforcement into the lintel or the beam etc.

14.0 Placement of reinforcement for stairs spanning longitudinal case (with specific attention at the junction of waist and landing slabs)
14.1 Read the reinforcement details from the bar bending schedule.
14.2 Prepare the shuttering for the stairs as per the design.
14.3 Bend the reinforcing bars to the shape and length confirming to the bar bending schedule.
14.4 Place the bars at the specified spacing maintaining the cover with the help of chairs or cover blocks.
14.5 Exercise care in the placement of reinforcement of at the junction of waist and loading slab.
14.6 Tie the distributors parallel to raisers at the specified spacing.

15.0 Placement of reinforcement for slab (with specific attention of chairs)
15.1 Prepare the reinforcement as per design
15.2 Rest the reinforcement in slabs on bar chairs
15.3 Securely fix to the bar chairs so that it won’t move when concrete is placed around it.
15.4 Locate reinforcing bars and mesh so that there is enough room between the bars to place and compact the concrete.
15.5 Anchor the reinforcement to improve the transfer of tensile forces to the steel by bending or hooking or lapping the bars.

16.0 Placement of reinforcement for a beam column junction (with specific attention to Earth quake resistance design)
16.1 Read the reinforcement details from the bar bending schedule
16.2 Note down proper cover-clear cover, nominal cover or effective cover to reinforcement.
16.3 Decide detailed location of opening/hole and supply adequate details for reinforcements around the openings.
16.4 Show enlarged details at corners, intersection of beams and column junction
16.5 Avoid congestion of bars at points where members intersect and make certain that all reinforcement is properly placed.
16.6 In the case of bundled bars, Make lapped splice of bundled bars by splicing one bar at a time
16.7 Stagger such individual splices within the bundle.
16.8 Make sure that hooked and bent up bars can be placed and have adequate concrete protection.

Key competencies to be achieved by the student

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<tr>
<th>S.No</th>
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<tr>
<td>No.</td>
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<td>Instructions</td>
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</tr>
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<td>Mark centre of the outer reinforcing rods of footing in either direction.</td>
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8. Supervisory skills of Plastering of a wall.
9. Supervisory skills for construction of Cement Concrete Flooring.
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16. Placement of reinforcement for a Beam column junction (with specific attention to Earth quake resistance design).

REFERENCE

1. CPWD SPECIFICATIONS, Govt of India Vol I&II, 2009
2. Practical Civil engineering hand book – Kale and Shaw
3. Building Construction – Bindra & Arora
4. National Building Code- BIS publication
### Theory:

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Instruction period / week</th>
<th>Total Period / year</th>
<th>Scheme of Examination</th>
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<tr>
<td>CE- 601</td>
<td>Steel Structures</td>
<td>5</td>
<td>75</td>
<td>3</td>
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<tr>
<td>CE- 602</td>
<td>Environmental Engineering - II</td>
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<td>CE- 603</td>
<td>Construction Technology &amp; Valuation</td>
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**TOTAL**: 23 periods

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<td>CE- 607</td>
<td>S.E. Drawing</td>
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<td>CE- 608</td>
<td>Construction Technology Lab</td>
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<td>CE- 609</td>
<td>Project Work</td>
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**TOTAL**: 19 periods

### Total:

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<th>Scheme of Examination</th>
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**TOTAL**: 630 periods

**Total Marks**: 900
DESIGN OF STEEL STRUCTURES

Subject Title : DESIGN OF STEEL STRUCTURES
Subject Code : CE-601
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

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<tr>
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<th>Weightage of Marks</th>
<th>Short Type</th>
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<td>1.</td>
<td>Introduction and Fundamentals of Limit State Design of Steel structures</td>
<td>02</td>
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<td>2.</td>
<td>Design of fillet welded joints</td>
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OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Know the Introduction and fundamentals of limit state design of steel structures

1.1 Know the common types of steel structures.
1.2 State the merits and demerits of Steel Structures.
1.3 Lists the loads considered in the design of steel structures as per I.S:875-1987.
1.4 Describe briefly various types of loads to be considered in the design of steel structures.
1.5 Understand the code of practice I.S. 800-2007.
1.6 Know the physical and mechanical properties of structural steel.
1.7 Sketch different types of rolled steel sections.
1.9 Explain briefly the classification of cross sections class 1 to 4.
1.10 List the types of elements.
1.11 Understand the Concept of Limit State Design.
1.12 Define the term 'limit state'.
1.13 State the various types of limit states.
1.14 Define the terms: characteristic action, design action, design strength.
1.15 Know the partial safety factor values for loads in limit state of strength and serviceability.
1.16 Know the partial safety factor values for materials in limit state.
1.17 State the deflection limits for simply supported beam, cantilever beam and purlins.
2.0 Understand the principles of design of Fillet Welded Joints

2.1 State the different types of joints.
2.2 Differentiate the welded joints and Riveted joints.
2.3 Sketch the different forms of welded joints.
2.4 Explain the features of a fillet welded joint.
2.5 State stresses in welds as per I.S.800-2007.
2.6 Know the formula for design strength of a fillet welded joint.
2.7 Calculate the design strength of a fillet welded joint.
2.8 Design a fillet welded joint for a given load, thickness of a plate and permissible stresses as per code.
2.9 Design a fillet welded joint for a single angle connected to the gusset plate by fillet welds along the sides and at ends carrying axial loads.
2.10 Design a fillet welded joint for a double angle connected to the gusset plate by fillet welds along the sides and at ends carrying axial loads.

3.0 Understand the principles of design of Tension Members

3.1 Define the term ‘tie’.
3.2 Know the applications of tension members.
3.3 Sketch different forms of tension members.
3.4 Understand the behaviour of tension members.
3.5 State the different modes of failures.
3.6 Describe briefly with sketches the different modes of failures of tension members.
3.7 Know the maximum values of effective slenderness ratios as per code.
3.8 Determine the net effective area of single angle connected to gusset plate by welding.
3.9 Determine the design strength due to yielding of gross section, rupture of critical section and block shear failure of a single angle connected by welding.
3.10 Understand design procedure of tension members.
3.11 Design a single angle tension member connected by welding only.

4.0 Understand the principles of design of Compression Members, Columns and Column bases

4.1 Understand the compression members.
4.2 Know different types of compression members like column, strut, etc.
4.3 Sketch different forms of compression members.
4.4 Understand the behaviour of compression members - classification of cross sections.
4.5 Understand the terms: actual length and effective length.
4.6 Define the terms a) least radius of gyration b) slenderness ratio.
4.7 State effective lengths to be used for different end conditions.
4.8 Understand buckling class of cross section – imperfection factor and stress reduction factor for different buckling classes – column buckling curves.
4.9 Know the maximum values of effective slenderness ratios as per code.
4.10 Understand the design compressive stress for different column buckling classes.
4.11 Determine the design strength of compression members.
4.12 Understand design procedure of compression members.
4.13 Design columns with I sections and built up channel sections.
4.14 Understand design details - effective sectional area – codal provisions for angle struts.
4.15 Design single angle and double angle struts.
4.16 Understand codal provisions of single / double lacing and battening for built-up columns.
4.17 Design a slab base along with a cement concrete pedestal also design the welded connection.

5.0 Understand the principles of design of Steel Beams
5.1 Understand the concept of limit state design of beams
5.2 Define the terms: elastic moment of resistance, plastic moment of resistance, elastic section modulus, plastic section modulus, shape factor.
5.3 Determine the shape factor values for rectangular, T,I section
5.4 Understand the behaviour of steel beams.
5.5 State the classification of beams based on lateral restraint of compression flange.
5.6 Determine the design strength in bending(flexure) and in shear.
5.7 Know the factors affecting lateral stability – influence of type of loading.
5.8 Describe briefly: web buckling and web crippling.
5.9 Understand the beams failure by flexural yielding – types.
5.10 Understand laterally supported beam – holes in tension zone – shear lag effects – design bending strength.
5.11 Understand laterally unsupported beam – lateral torsional buckling of beams (theoretical concept only – no problems).
5.12 Know the effective length of compression flanges.
5.13 Understand concept of shear in beams – resistance to shear buckling.
5.14 Know the shear buckling design methods - simple post critical method– tension field method.
5.15 Understand the design of simple beams with solid webs.
5.16 Understand component parts of plate girders with sketches – describe different types of Stiffeners with their suitability.
5.17 Design laterally supported simply supported beam considering all codal requirements.

6.0 Understand the principles of design of Roof Trusses
6.1 Know types of trusses – plane trusses, space trusses.
6.2 Understand the situations where roof trusses are used.
6.3 Sketch different types of roof trusses with their suitability for a given span.
6.4 Sketch a roof truss and name the component parts.
6.5 Know configuration of trusses – pitched roof, parallel chord trapezoidal trusses.
6.6 Know cross sections of truss members.
6.7 Understand the loads on roof trusses as per I.S – 875.
6.8 Describe briefly how the wind load is calculated on roof trusses.
6.9 Determine loads at nodal points of a given roof truss due to dead load, live load and wind load, given the coefficients K1, K2, K3, design wind speed, design wind pressure, external and internal pressure coefficients.
COURSE CONTENT

1.0 Introduction and fundamentals of limit state design of steel structures
1.1 Merits and demerits of steel structures.
1.2 Loads considered in the design of steel structures as per I.S:875 -1987.
1.3 Introduction to I.S. 800-2007 - Mechanical properties of structural steel – yield stress (fy), ultimate tensile stress (fu) and maximum percent elongation (table 1 of IS:800-2007)
1.4 Standard structural sections – Classification of cross sections – class 1(plastic) class2(compact) class3(semi compact) and class4(slender) – types of elements –internal elements, outstands and tapered elements.

2.0 Design of Fillet Welded Joints
2.1 Different types of joints – lap joints – butt joints.
2.2 Differentiation of welded joints and riveted joints.
2.3 Different forms of welded joints – sketches of fillet and butt weld joints.
2.4 Fillet welded joint – detailed sketch showing the component parts.
2.5 Stresses in welds as per I.S.800-2007 – Codal requirements of welds and welding.
2.6 Problems on calculation of strength of a fillet welded joint.
2.7 Design of fillet welded joint for a given load, thickness of a plate and permissible stresses as per code.
2.8 Design of fillet welded joint for single or double angles carrying axial loads.

3.0 Design of Tension Members
3.1 Introduction to tension members and different forms of tension members.
3.2 Behaviour of tension members.
3.3 Different modes of failures – gross section yielding, net Section rupture and block shear failure.
3.4 Maximum values of effective slenderness ratios as per code.
3.5 Calculation of net effective sectional area of single angle with welded connection only.
3.6 Calculation of the design strength due to yielding of gross section, rupture of critical section and block shear – problems on single angle with welded connection only.
3.7 Design procedure of tension members.
3.8 Problems on design of tension members single angle with welded connection only.

4.0 Analysis and design of Compression Members, columns and column Basis
4.1 Introduction to compression members - different forms of compression members.
4.2 Behaviour of compression members – classification of cross sections -
Classification of cross sections – class 1 (plastic) class2 (compact) class3
(semi compact) and class4 (slender).
4.3 Effective lengths to be used for different end conditions – table 11 of I.S:800.
4.4 Buckling class of cross section – imperfection factor and stress reduction
factor for different buckling classes – column buckling curves.
4.5 Maximum values of effective slenderness ratios as per code – design
compressive stress for different column buckling classes.
4.6 Calculation of design strength of compression members – problems.
4.7 Design procedure of compression members – problems on simple sections
only (no builtup sections).
4.8 Design details - effective sectional area – codal provisions for angle struts –
single angle and double angle – discontinuous and continuous struts.
4.9 Codal provisions of single / double lacing and battening for built-up columns
(no problems).
4.10 Design of slab base along with a cement concrete pedestal, design of welded
connection of base plate and column – problems.

5.0 Analysis and design of Steel Beams
5.1 Concept of limit state design of beams – shape factor and plastic properties of
beams – Problems on shape factor.
5.2 Behaviour of steel beams – design strength of in bending (flexure).
5.3 Factors affecting lateral stability – influence of type of loading-web buckling
and web crippling.
5.4 Beams failure by flexural yielding – types.
5.5 Laterally supported beam – holes in tension zone – shear lag effects — design
bending strength
5.6 Laterally unsupported beam – lateral torsional buckling of beams - (theoretical
concept only – no problems).
5.7 Effective length of compression flanges.
5.8 Concept of shear in beams – resistance to shear buckling.
5.9 Shear buckling design methods - simple post critical method – tension field
method.
5.10 Design of laterally supported simple beams with solid webs.
5.11 Component parts of plate girders with sketches – brief description of different
types of stiffeners.
5.12 Design of laterally supported simply supported beam considering all codal
requirements.

6.0 Design of Roof Trusses
6.1 Types of trusses – plane trusses, space trusses.
6.2 Sketches of different roof trusses with their suitability for a given span.
6.3 Cross sections of truss members.
6.4 Loads on roof trusses as per I.S – 875.
6.5 Determination of loads at nodal points of a given roof truss due to dead load,
live load and wind load, given the coefficients K1, K2, K3 ,design wind speed,
design wind pressure ,external and I nternal pressure coefficients.— problems.

REFERENCE
1. Steel Structures Design & Practice by N.Subramanian, oxford University Press
3. Limit state Design of Steel Structures by S.K. Duggal/TMH
4. Structural steel design by M.L.Gambhir/TMH
5. Design of Steel Structures by S.S.Bhavikatti
6. Structural Engineering by A.P.ArulManickam
8. Teaching Resource Material : http://www.nptel.iitm.ac.in

ENVIRONMENTAL ENGINEERING – II

Subject Title : Environmental Engineering - II
Subject Code : C-602
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

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OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Know the basic facts of sanitary engineering and Quantity of sewage.

1.1 State the objects of sewage disposal works.
1.2 Define the terms: sewage, Sewer, sullage.
1.3 Know about the terms : sewerage, refuse, garbage
1.4 List the objects of sewerage works.
1.5 List the various methods of sewage collection works.
1.6 Compare conservancy system with water carriage system.
1.7 Explain the different sewerage systems.
1.8 Compare the systems of sewerage with each other.
1.9 Know which system of sewerage is preferable for towns with small and evenly distributed rainfall.
1.10 Understand which system of sewerage is used for a city like Hyderabad. Justify
1.11 State the main constituents of sewage for calculating quantity.
1.12 Define the term Dry weather flow.
1.13 State the factors affecting dry weather flow.
1.14 State the factors that affect the quantity of storm sewage.
1.15 Explain the variation in rate of sewage.
1.16 Estimate the quantity of storm water flow using rational method and empirical formulae.
1.17 List the requirements of good surface drains.
1.18 Describe the different types of surface drains with their merits and demerits.
1.19 State the limiting velocities of flow in sewers.
1.20 Works out simple problems on design of sewers running half full only.
1.21 Explain the use of nomograms in detail in the design of sewers.

2.0 Understand the Types of sewers, laying of sewers and appurtenances
2.1 State the various shapes of sewers.
2.2 Explain the circular sewer with the help of a sketch and list any two merits and demerits.
2.3 Mention the different materials used for sewers.
2.4 State any two merits and demerits for each type of sewer.
2.5 Explain the method of laying the sewers as per given alignment.
2.6 Know, why is it necessary to provide sewer appurtenances on the sewer lines.
2.7 List the various sewer appurtenances on a sewer line.
2.8 Explain the necessity of providing manhole in sewer line with the help of sketch.
2.9 Explain the construction, function and location of the different sewer appurtenances.
2.10 Know, why is it necessary to ventilate the sewers and how is it done.
2.11 State the situations under which sewage pumping is necessary.
2.12 Explain the component parts of a pumping station and factors influencing its location.
2.13 Explain the construction and working of Shone’s ejector with the help f a sketch.
2.14 Know, how the testing of sewers is done.
2.15 Understand why explosions occur in sewer lines and how they can be prevented.

3.0 Understand the characteristics of sewage
3.1 Define strength of sewage.
3.2 Describe the method of sampling sewage.
3.3 State the physical, chemical and biological characteristics of sewage.
3.4 Define C.O.D and B.O.D
3.5 State the significance of the following tests to Analyse sewage.
3.6 State the characteristics of industrial waste water.
3.7 Explain the principles of treatment of industrial wastewater.
3.8 State the objects of sewage treatment.
3.9 Draw the conventional sewage treatment plant of a town and indicate the main function of each unit.
3.10 State the function of screens, skimming tanks and grit chambers.
3.11 Explain briefly the working of screens, grit chambers, skimming tanks.
3.12 Describes with sketch wherever necessary the following treatment works.
   a) sedimentation tank.
   b) Trickling filters.
   c) Activated sludge process.
   d) Oxidation ditch.
   e) Oxidation pond.
   f) Aerated lagoons.
   g) Anaerobic lagoons.
   h) Sludge digesters
3.13 Compare activated sludge process and trickling filters.
3.14 List out various methods of sludge disposal.
3.15 Explain the methods of sludge disposal.
3.16 Explain with sketch the treatment of sewage by septic tank and soak pit.
3.17 Determine the dimensions of a sedimentation tank and a septic tank for given data.
3.18 List the various methods of sewage disposal.
3.19 Explain the methods of disposal of sewage.

4.0 Know the methods of disposal of solid wastes and Sanitation in Building
4.1 Define the term ’Refuse’
4.2 State the classification of solid wastes.
4.3 Explain the methods of disposal of solid wastes.
4.4 State any two merits and two demerits for each of the solid waste disposal methods.
4.5 Know, what is meant by composting.
4.6 Explain the methods of composting.
4.7 List the equipments required for preparation of compost by mechanical composting.
4.8 State the aims of building drainage.
4.9 State the requirements of good drainage system in buildings.
4.10 Know about the terms: soil pipe, waste pipe, vent pipe, anti-syphonage pipe.
4.11 Describe the layout of sanitary fittings and house drainage arrangements for buildings (single and multi-storied).
4.12 Explain with sketches the different types of plumbing systems.
4.13 Describe different sanitary fittings like water closets, flushing cisterns, urinals, inspection chambers, traps, anti-siphonage pipes.
4.14 Explain the procedures involved in the inspection, testing and maintenance of sanitary fittings.

5.0 Knows the methods of rural sanitation
5.1 Explain the process of disinfection of wells by two pot method.
5.2 List the different types of sanitary latrines.
5.3 Explain the methods of rural sanitation.
5.4 Describe with sketches the construction of sanitary latrines in rural areas.
5.5 State the advantages of bio-gas plant.
5.6 State the factors on which the production of bio-gas depends.
5.7 Describe the construction and working of K.V.I.C.model bio-gas plant with a neat sketch.
5.8 Describe the construction and working of Janata model bio-gas plant with a sketch.
5.9 Know about vermi composting.
5.10 Describe briefly the procedure of vermi composting and mention its advantages.

6.0 Know the effects of air pollution and its control
6.1 Define the term air pollution.
6.2 State the sources of air pollution.
6.3 Explain the natural and manmade sources of air pollution.
6.4 List the effects of air pollution.
6.5 Explain the effects of air pollution on human health and vegetation.
6.6 Explain the effects of air pollution on atmosphere and materials.
6.7 List the methods of control of air pollution.
6.8 Explain the method of prevention of air pollution at source.
6.9 List the various types of controlling devices and equipment.
6.10 Explain briefly with sketches the methods of controlling air pollution by controlling devices and equipment.
6.11 Describe briefly the control of air pollution by stacks.
6.12 Explain the method of prevention of air pollution by vegetation.

COURSE CONTENT

1. Introduction and Quantity of Sewage
   a) Object of providing sewerage works.
   b) Definition of terms: sullage, sewage, sewer and sewerage – classification of sewage.
   c) System of sewage disposal - conservancy and water carriage systems.
   d) Types of sewerage systems and their suitability – separate, combined and partially separate systems.
   e) Quantity of discharge in sewers, dry weather flow, variability of flow.
   f) Determination of storm water flow – run off co-efficient, time of concentration, rational method and empirical formulae for run-off.
   g) Surface drainage - requirements, shapes, laying and construction.
   h) Simple problems on design of sewers (running half full only) using Manning’s and Hazen Williams formulae.
   i) Use of nomograms as per I.S.1742 to determine the unknown values of gradient, diameter, discharge and velocity.

2. Laying of Sewers and Sewer Appurtenances
   a) Different shapes of cross section for sewers – circular and non-circular – merits and demerits of each.
   b) Brief description and choice of types of sewers - stone ware, cast iron, cement concrete sewers and A.C Pipes.
   c) Laying of sewers - setting out alignment of a sewer, excavation, checking the gradient, preparation of bedding, handling, lowering, laying and jointing, testing and back filling.
   d) Brief description, location, function and construction of
      i) Manholes.
      ii) Drop manholes.
      iii) Street inlets.
      iv) Catch basins.
v) Flushing tanks.
vi) Regulators.
vii) Inverted siphon.

e. Necessity of pumping sewage - location and component parts of a pumping station.

3. Sewage Characteristics

a) Strength of sewage, sampling of sewage, characteristics of sewage; physical, chemical and biological.
b) Analysis of sewage - significance of the following tests for (No details of tests)
c) Characteristics of Industrial waste water–principles of treatment, Reduction of volume and strength of wastewater, Equalization, Neutralization and proportioning.
d) Preliminary treatment - Brief description and functions of following units.  
   (i) Screens, (ii) Skimming tanks and (iii) Grit chambers.
e) Primary treatment - Brief description and functions of Plain sedimentation, simple problems on the design of sedimentation tanks.
f) Secondary treatment - Brief description of 
   (i) Trickling filters (ii) Activated sludge process (iii) Oxidation ditch
   (iv) Oxidation pond (v) Aerated lagoons (vi) Anaerobic lagoons

g) Sludge digestion – Process and methods of sludge disposal.

h) Miscellaneous treatments-septic tank.
i) Sewage disposal - dilution, disposal on to lands, ground water recharge, reuse etc.

4. Solid Waste Disposal and Sanitation in Buildings

a) Methods of disposal - uncontrolled dumping, tipping or sanitary land fill – Incineration - composting.
b) Preparation of compost - equipments required such as storage hoppers, grinders conveyors etc., in mechanical composting.
c) Aims of building drainage and its requirements – General layout of sanitary fittings to a house - drainage arrangements for single and multi storeyed buildings as per IS code of practice-plumbing systems.
d) Sanitary fittings – traps, water closets, flushing cisterns, urinals, inspection chambers, anti siphonage - Inspection, testing and maintenance of sanitary fittings.

5. Rural Water Supply and Sanitation

a) Disinfection of wells.
b) Rural sanitation and sanitary latrines, biogas production technology -brief 
   description and operational details of bio-gas plants using animal waste, night soil and agricultural wastes -KVIC and JANATA models- merits and demerits-
   maintenance of biogas plant.
c) Vermi composting –procedure -advantages

6. Air Pollution

a) Definition - sources of air pollution – effects of population.
b) Control of air pollution – methods - air pollution control at source – zoning – installation of controlling devices and equipment : internal separators, gravity settling chambers, cyclones, fabric filters, wet collection devices : cyclonic
scrubbers, venture scrubbers, electrostatic precipitators - brief description of the above equipment – air pollution control by stacks – by vegetation.

REFERENCE

1. Environmental Engineering – G.S. Birdie
2. Elements of Public Health engineering – K.N. Duggal
3. Environmental Engineering – Baljeet Kapoor
5. Environmental Engineering – Ramachandraiah
7. Environmental Engineering --N.N.Basak/TMH

CONSTRUCTION TECHNOLOGY AND VALUATION

Subject Title                   : Construction Technology and Valuation
Subject Code                   : CE-603
Periods per Week               : 05
Periods per Semester           : 75

TIME SCHEDULE

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OBJECTIVES

After completion of the subject, the student shall be able to

1.0 **Understands the concrete Technology**
   1.1 State the ingredients of Concrete.
   1.2 Define Workability
   1.3 Defines Water/Cement ratio
   1.4 Explain the relation between strength of concrete, workability and water/cement ratio
   1.5 Knows about ‘Grades’ of concrete and state the grades of concrete recommended for different types of works.
   1.6 Knows about ‘Normal strength concrete and High strength concrete’
   1.7 Differentiate between ‘Ordinary Concrete and Controlled Concrete’
   1.8 State the functions of Admixtures in concrete and list out different admixtures being used.
   1.9 State the Principles of Concrete Mix Design.
   1.10 State the factors affecting variability of concrete strength.
   1.11 Explain the procedure of Concrete Mix design using IS Code method
   1.12 Knows about various special concretes like Fiber Reinforced Concrete, Fal-G-Concrete, Light weight concrete, High density concrete, Polymer concrete and Self compacting concrete
   1.13 Knows about concreting under special exposure conditions like under-water concreting, cold weather concreting, hot weather concreting and concreting in high rise buildings
   1.14 Knows about ‘Micro concrete’ and ‘Shotcrete’.
   1.15 State the necessities of Expansion and Construction joints in concrete structures.
   1.16 Explain the method of providing various joint in RCC roofs.

2.0 **Understand the Pre stressed concrete**
   2.1 To understand fundamental principles of pre stressed concrete.
   2.2 To know the materials and permissible stresses.
   2.3 To understand the losses of pre stress.
   2.4 To know the methods of pre stressing and post-tensioning systems.

3.0 **Understand Form work and Reinforcement**
   3.1 State the Objectives of Formwork.
   3.2 State the requirements of formwork.
   3.3 List the loads to be considered for the design of formwork.
   3.4 Draw the formwork arrangements for Slab & Beam system, Column, wall.
   3.5 State the merits and demerits of Steel formwork over Timber formwork.
   3.6 State the chemical composition of structural steel as per IS.
   3.7 State the different types of steels used for concrete reinforcement along with their mechanical properties.
   3.8 Explain the bond mechanism in plain and deformed bars.

4.0 **Know the Construction Machinery and Equipment**
   4.1 Understands the need for mechanization and construction activities
   4.2 State the different types of construction equipment and explain.
4.3 State the factors to be considered for the selection of type of construction equipment.

5.0 Understand the Buildings services
5.1 Explain the hot water supply distribution using solar water heating system.
5.2 State the requirements of good lighting in building.
5.3 Define the terms ‘glare’ and ‘day light factor’.
5.4 State the precautions to be taken to avoid glare in building.
5.5 State the requirements of good electrical wiring.
5.6 List the power rating of different domestic electrical appliances.
5.7 List the different types of electrical wirings.
5.8 State the objectives of electrical earthing and explain the method of earthing.
5.9 State the requirements of good ventilation.
5.10 Explain natural and artificial ventilation.
5.11 State the functions of sunshades, louvers, sun breakers, and blinds.
5.12 State the principles of fire protection in buildings.
5.13 State the causes of fire.
5.14 Explain about fire fighting.
5.15 State different fire detectors and fire extinguishers.
5.16 State different fire resistant building materials.
5.17 Defines and states purpose of air conditioning.
5.18 State different types of cooling systems.

6.0 Understand Earthquake resistant structures
6.1 Understand the causes, basic terminology, characteristics, seismic zoning
6.2 To know seismic construction with brick and stone masonry buildings as per codal provisions.
6.3 Understand seismic construction and detailing of R.C. buildings as per codal provisions.

7.0 Understand the concept of Building Valuation
7.1 Define the terms: ‘value’, ‘cost and price’.
7.2 State the necessities of valuation.
7.3 Explain the terms – depreciation, sinking fund, annuity and capitalized value.
7.4 Lists and explains different methods of valuation of buildings.
7.5 State and Explain methods of rent fixation of building.

COURSE CONTENT
1.0 Concrete Technology
b) Curing of Concrete-Method of curing.
c) Grade of concrete-Controlled concrete and Ordinary concrete-Normal strength concrete and High strength concrete
e) Mix design – Factors influencing mix design – Methods of Mix design – IS 10262-2009 method of mix design.
f) Special Concretes – fiber reinforced Concrete – Fal G-Concrete, high density Concrete, Light weight Concrete, polymer Concrete and micro Concrete – Self Compacting Concrete – Properties – uses.

g) Concreting under special exposure condition – cold weather Concreting – hot weather Concreting – under water concreting – Shortcrete – Concreting in high rise buildings.


2.0 Pre stressed Concrete
a) Introduction – Basic principles – Systems of pre stressing – Types of pre stressing – Advantages and Disadvantages.
b) Requirements of steel and concrete for pre stressed concrete.
c) Losses of Pre stress.

3.0 Form work and reinforcement
a) Objectives of form work – Loads acting on form work – Component parts of ordinary form work for columns, beams and slabs.(with sketches)
b) Types of formwork based on the material used – Wooden form work–Steel form work.
c) Cleaning and treatment of forms – Stripping time – tolerances.
d) Slip form work for towers and Form work for Lining of canals.
e) Reinforcement – types – Properties as per IS.
f) Bending, Fixing, Placing, Tying and Welding.

4.0 Construction machinery and equipment
a) Need for use of construction Machinery.
b) Factors affecting selection of equipment.
c) Types – Crawler and Pneumatic tyred.
f) Hauling equipments – Trucks, Dump trucks, Dumpers.
g) Cranes – Tower cranes.
h) Conveying equipments – Belt conveyors.

5.0 Building Services
a) Hot water supply using solar water heating system.
b) Lighting requirements in a building – daylight factor – glare.
c) Electrical services – Requirements of good electrical wiring – types of electrical wirings – earthing – methods.
d) Ventilation – Requirement of good ventilation – Natural and Artificial ventilation – purpose of sunshades, louvers, and blinds.
e) Air conditioning – Purpose – Air conditioning layout – Components – Types of cooling systems – Air coolers – Air conditioner – Centralized Air conditioner – Split type Air Conditioner.
6.0 **Earthquake resistant structures**
   b) Seismic construction of brick and stone masonry buildings – Provisions of I S : 4326.

7.0 **Building Valuation**
   b) Depreciation – Sinking fund – Annuity – Capitalized value.
   c) Methods of valuation – Land & building method, Development method, Depreciation method, Rental method, Capitalization method, Profit method, Simple problems on each of the above method.

**REFERENCE**

1. *Construction Technology* by Sarkar, Oxford University Press
3. *Concrete Technology* by M S Shetty
4. *Building Technology and valuation* TTTI, Chennai
5. *Hand book on Design of Concrete mixes* S.P.23
CONSTRUCTION FAILURES, REPAIRS AND MAINTENANCE

Subject Title : Construction failures, repairs and maintenance
Subject Code  : CE-604
Periods/ week : 05
Periods/year  : 75

TIME SCHEDULE

<table>
<thead>
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OBJECTIVES

Upon completion of the study of the subject, the students should be able to

1.0 Introduction
1.1 Define error, defect and failure.
1.2 States different types of errors causing failures.
1.3 States the causes of failures.
2.0 Understand subsurface construction failures and repairs


2.2 Describe the repairs involved for rectifying the above failure.

2.3 Describe Sub surface construction failures – Trenches, sheeting and bracing, piles and caissons – Sewer and tunnels, dams.

2.4 Describes the repairs involved for rectifying the above failures.

3.0 Understand Surface construction failures and repairs

3.1 Briefly describes the following types of failures in surface construction – Slopes and slides – Subsidence, retaining walls and abutments.

3.2 Briefly describes the repairs involved for rectifying the above failures.

4.0 Understand Masonry and concrete failures, repairs

4.1 Describe types of failures in masonry – Wall failure, construction error, aging, joints and cracks, weather tightness, masonry cladding, partitions, ornamental screens, plaster.

4.2 Explain the repairs involved for rectifying the above failures.

4.3 Explain the types of failures in concrete – Improper mix design, curing, placement of reinforcement, Rusting of embedded steel, handling of pre cast elements, shrinkage, expansion and plastic changes, surface disintegration due to fire, spalling of concrete, compression failure, erection difficulty, temperature change, Deformation and cracking – repairs.

4.4 Explain the repairs involved for rectifying the above failure- use of expansion filler.

5.0 Understand Manmade and natural failures and repairs

5.1 Describe the following types of failures in manmade and natural disasters.

5.2 Demolition, deterioration, overload, alteration collapses, fire, explosion and vibration, collision, wind damages, towers and masts, storm at sea, storm on land, lightening damage, rain-ponding effect – Explain the repair’s involved for rectifying the above failure.

5.3 Describe the failures due to ignorance and negligence – Ignorance, or incompetence, negligence, control and supervision, responsibility.

5.4 Explain the repairs involved for rectifying the above failures.

6.0 Understand the Maintenance problems and their solutions

6.1 Describes the list of defects in buildings bringing out the investigation and remedial details.

6.2 State the methods of solving dampness problems in buildings.

6.3 Explain the causes, preventive and corrective methods of cracks in building.

6.4 Explain the maintenance operations for the Water supply and sanitary components of building.

6.5 Explain the methods of maintenance of roads / road berms / side drains.

6.6 Explain methods of repairs to canal linings.

6.7 Use of Leak proof chemicals for R.C.C roofs.
COURSE CONTENT

1. **Introduction**
   a) Definition of error, defect, failure – Causes of failures.

2. **Sub-surface construction failures and repairs**
   b) Failures during excavation – Sheeting and bracing – piles and caissons – sewers and tunnels – measures to be taken.

3. **Surface construction failures and repairs**

4. **Masonry and concrete failures, repairs**

5. **Man-made and natural failures, rehabilitation**

6. **Maintenance problems and their solutions**
   b) Cracks in walls – Horizontal, Vertical, diagonal – causes and prevention of cracks in buildings – Care of floors, removing stains from floors – Inks, rust, oil, paint and varnish.
c) Maintenance problems of plumbing, heating, hot water supply, clogged drains, sewers, leaking pipe joints, electrical installations, other building services, septic tanks and soak pits.

d) Maintenance of roads, road-berms and side drains.

e) Strengthening of canals, embankments, silt clearance weed removal, repairs to canal lining.

f) Leak proofing of water tanks and roofs use of chemicals for RCC roofs.

REFERENCE

4. Learning from Failures by Raikar
6. Maintenance Engineering for Civil Engineers-- Nayak B.S. , Khanna Publisher’s, Delhi
7. SP: 25 –1987 Causes and prevention of cracks in buildings by BIS

QUALITY CONTROL & SAFETY IN CONSTRUCTION

Subject Title : Quality control & Safety in construction
Subject Code : CE-605
Periods/ week : 04
Periods/year : 60

TIME SCHEDULE

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<td>4</td>
<td>Introduction to safety in construction Activities</td>
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</table>

OBJECTIVES
After completion of the subject, the student shall be able to

1.0 Know different specifications and standards
   1.1 State different specifications of buildings.
   1.2 Explain functional aspects of different structures.
   1.3 Describe detailed specification for various items of work.
   1.4 Prepare detailed specification from general description.
   1.5 List relevant IS codes.
   1.6 Identify sizes for building components.
   1.7 Identify standards.
   1.8 Understand standards for industrial buildings.
   1.9 Explain Management aspects of quality control.
   1.10 Describe Advisory Organization.
   1.11 Describe Management Functions and Regulations.
   1.12 State PWD & CPWD Guidelines for field officers.

2.0 Understand the production and Quality control of construction works and Tolerance levels
   2.1 Describe control aspects of batching and mixing.
   2.2 Explain the inspection of reinforcement grills.
   2.3 Explain the inspection and examination of formwork.
   2.4 Describe the quality of the filler materials.
   2.5 Establish relationship between the strength of brickwork and strength of mortar.

3.0 Understand statistical basis for modern quality control
   3.1 Describe Mathematical probability.
   3.2 Describe sampling plan.
   3.3 Explain sampling risks of acceptance and rejections.
   3.4 State the tolerances levels in construction industry.
   3.5 Understand visual appearance.
   3.6 State the dimensional accuracies.

4.0 Understand the safety aspects to be taken in construction works
   4.1 Describe the safety requirements against fire hazards
   4.2 Describe the safety while using construction machinery
   4.3 Describe the safety during the demolition of buildings
   4.4 Describe the preventive methods of accidents

5.0 Understand the causes of Accidents and Safety measures
   5.1 Defines accidents.
   5.2 List the causes of accidents.
   5.3 Role of loss control approach in the cost of the accidents.
   5.4 Describe the cost aspects of accidents and measures.
   5.5 Describe the General safety program.
   5.6 Prepare accidents reports.
   5.7 Describe the safety measures to be taken for storage and handling of building materials.
   5.8 Describe the safety requirements in formwork and scaffolding.
   5.9 Explain the safety in excavation & pile driving in foundation.
   5.10 Describe the safety measures to be taken in construction of building elements.
   5.11 Describe the safety measures to be taken in demolition of buildings.
5.12 Describe the safety measures to be taken for hot bituminous works.
5.13 Describe the safety measures to be taken in supporting structural work.

6.0 Understand the Planning for accident prevention
6.1 Define risk, risk management.
6.2 Role of risk management.
6.3 Describe the planning for accident prevention.
6.4 Evaluate risks and losses and cost control works
6.5 Describe the management measures for controlling losses

COURSE CONTENT

Quality Control

(b) Management aspects of quality control – advisory organization management functions – Statutory regulations – State PWD & CPWD guide lines for field officers.

(b) Quality control in Masonry works – quality of filler materials – Brick – stone – quality of mortar – relation between strength of brick work Vs strength of bricks Vs strength of mortar.

3. (a) Statistical basis for modern quality control – Simple examples of mathematical probability – Sampling plan – Sampling risks of acceptance and rejection.
(b) Tolerance levels in construction industry – Visual appearance – dimensional accuracies.

Safety


REFERENCE

1. Design of Foundations & Detailing by Er.A.Veerappan & Er. A.Pragadeeswaran
3. Norbert-L.Enrick “Quality control and reliability” Industrial press Inc., NY
6. Estimation and Costing by Dutta
7. S.Purushotham & G. Vaidyanathan “Safety in Construction Industry”, Central Labour Institute, Bombay
8. “Accident Prevention in Construction”, Associated General Contractors of America
9. Standards on safety—BIS
10. Norbert-L.Enrick “Quality control and reliability” Industrial press Inc.,NY
### CIVIL ENGINEERING WORK SHOP

**Subject title:** Civil Engineering Workshop  
**Subject code:** CE-606  
**Periods per week:** 03  
**Periods per semester:** 45

#### TIME SCHEDULE

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<td>1</td>
<td>Carpentry</td>
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<td>Bar Bending of steel reinforcement</td>
<td>10</td>
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<tr>
<td>3</td>
<td>Plumbing exercises</td>
<td>10</td>
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<tr>
<td>4</td>
<td>Electrical Exercises</td>
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<td><strong>Total</strong></td>
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</table>

#### OBJECTIVES
After completion of the subject, the student shall be able to

1.0 Understand the elements of carpentry in connection with the erection of scaffolding and form work with a particular reference to use of braces.

1.1 State various components of scaffolding
1.2 State precautions to be taken while erecting scaffolding
1.3 Explain the method of fixing various elements of scaffolding
1.4 State precautions to be taken to fix the various elements of scaffolding at required position.
1.5 Connect various elements of scaffolding.
1.6 Study various aspects of form work to be considered while fixing various elements
1.7 Explain the method of fixing of form work at required position for various elements of building construction
1.8 Connect various elements of formwork.

2.0 Understand the skills of bending of reinforcing bars as per the bar bending schedule.

2.1 Identify various tools used for bending of reinforcing bars.
2.2 Read the data required from bar bending schedule for bending of bars.
2.3 Mark the salient points of location of bending on the bars as per the bar bending schedule.
2.4 Bend the bars using the specified tools to the exact shape as per bar bending schedule as specified in IS-2502 (Code of practice for bending and fixing of bars for concrete reinforcement)
2.5 Prepare the grills as per the drawings of the structural elements using binders, stirrups, links etc. appropriate to the element.

3.0 Understand the elements of plumbing practice and procedure of fixing of various plumbing fixtures

3.1 Identify the different pipe specials and state their functions
3.2 Practice thread cutting on PVC/GI pipes
3.3 Assemble the pipe line for toilet block with taps, showers and wash basins using specific pipe specials.
3.4 Fix the floor trap, gully trap and water closet of a house to the drainage pipes.

4.0 Understand the various aspects of electrical installations used in buildings and their fixing at appropriate locations

4.1 Identify various electrical accessories, Wires and cables
   a. Mains switch
   b. MCB
   c. Fuse
   d. Switches (SPST SPDT)
   e. Rotary switch
   f. Push Button Switches
   g. 2 pin Sockets
   h. 3pin /Power sockets
   i. Ceiling Rose
   g. Lamp Holders.
   (a) Identify line, neutral and earth terminals in power sockets and power plugs by physical observation and using Tester h. Use of test lamp
4.2 Identify different wires and cables
   a. Know the wire gauge
b. Specifications of electrical wires
c. VIR, PVC, TRS wires
d. Flexible wires and cables
e. Power cords.

4.3 Study of earthing and earth pit

4.4 Study of different wiring systems
   (a) Open conduit system
   (b) Concealed conduit system

4.5 Use of Digital Multimeter to
   a. Identify the Range selector
   b. Selection of appropriate range to measure
      i. AC Voltage
      ii. DC Voltage (Battery)
      iii. AC Current (Through a lamp/heater)
      iv. Check continuity
      v. Resistance

4.6 Connect a fuse in the main circuit
   a. Know the metals suitable for fuse wire
   b. Selecting a correct fuse wire rating for a given electrical load

4.7 Connect a low current (3A) MCB in the circuit and testing

4.8 Control the lamp using a switch

4.9 Control the fan with a switch and regulator

4.10 Connect a i) 2-pin socket ii) 2-pin socket with switch control

4.11 Control one lamp with 2 switches (Staircase wiring)

4.12 Know Power consumption of various Appliances like
   1. Tungsten Lamp
   2. CFL Lamp
   3. Fan.
   4. Fluorescent lamps (Tube Lights).
   5. Air cooler
   6. Water heater,
   7. Geiser
   8. Electric Iron

4.13 Estimate the total connected load

4.14 Study of inverter/UPS wiring

4.15 Electrical estimation and costing

4.16 Study of 3-phase system

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**KEY Competencies to be achieved by the student**

<table>
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<th>S. No</th>
<th>Experiment Title</th>
<th>Key Competency</th>
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<tbody>
<tr>
<td>1</td>
<td>Fixing scaffolding</td>
<td>• Measuring lengths of props accurately</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fixing braces at required locations correctly to support various other scaffolding members</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Choosing suitable size of members to support load coming over the scaffolding</td>
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</tbody>
</table>
2. Positioning of form work
   - Adjusting the lengths of props correctly to support the weight of RCC elements
   - Fixing up of various elements of form work firmly to support the weight of RCC elements

3. Bar Bending of steel reinforcement
   - Cutting of rods to the suitable lengths correctly
   - Maintaining the angle of cranking correctly
   - Maintaining required spacing of rods as per the design and drawings provided

4. Plumbing Exercises
   - Using appropriate tools
   - Selection of suitable pipe specials
   - Making connections to various sanitary installations

5. Electrical Exercises
   - Adopting suitable type of electrical fixtures for intended usage
   - Using suitable material in required quantities for making earthing for an electrical installation

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**COURSE CONTENT**

1. **Carpentry**
   - g. Erection of Scaffolding Material
   - h. Position of Shuttering
   - i. Fixing of form work.

2. **Bar Bending of steel reinforcement**
   - (a) Preparation of bar bending schedule
   - (b) Bar bending with bar bending schedule
   - (c) Method of bar bending for Earthquake resistant structures
   - (d) Filed visit to automated bar bending

3. **Plumbing exercises**
   - b. Thread cutting on GI/PVC pipes
   - c. Assembling of pipe lines for toilet with two taps, shower and wash basin
   - d. Fixing of floor traps, gully traps, water closet, drain pipes
   - e. Laying stoneware/PVC pipes and construction of inspection chambers

4. **Electrical Exercises**
   - i. Identity various electrical accessories
ii. Identify line, neutral and earth terminals in power sockets and power plugs
iii. Measure the AC voltage between line and neutral using DMM
iv. Study of earthing and earth pit
v. Study of different wiring systems
   1. Open conduit system
   2. Concealed conduit system
vi. Measurement of the following using DMM
   1. AC Voltage
   2. DC Voltage (Battery)
   3. AC Current (Through a lamp/heater)
   4. Check continuity
   5. Resistance
vii. Connecting a fuse in the main circuit
viii. Controlling the lamp using a switch
ix. Controlling the fan with a switch and regulator
x. Connect a i) 2-pin socket ii) 2-pin socket with switch control
xi. Control one lamp with 2 switches (Staircase wiring)
xii. Study of inverter/UPS wiring
xiii. Electrical estimation and costing
xiv. Study of 3-phase system
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<th>Short Type</th>
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<td>Reading and interpretation of Structural Drawings</td>
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NOTE: All questions are to answered. Part-A: 5X4=20 marks & Part-B: 2X20=40 marks

NOTE: Use HYSD bars for main reinforcement.

OBJECTIVES

After completion of the subject, the student shall be able to

1.0 Understand structural planning of a building and marking of Frame components
   1.1 Positioning & Orientation of columns

I-173
1.2 Positioning of beams
1.3 Spanning of slabs
1.4 Layout of stairs
1.5 Types of footings
1.6 Column reference scheme and
1.7 Grid reference scheme (Scheme recommended by IS:5525 – recommended for detailing of reinforced concrete works and SP-34)

2.0 Draw the detailed working drawings of R.C.C.
2.1 Draw the longitudinal section and cross sections of singly reinforced simply supported beam. Prepare schedule of reinforcement and quantity of steel.
2.2 Draw the longitudinal and cross section of lintel cum sunshade and prepare schedule of reinforcement and quantity of steel.
2.3 Draw the plan and longitudinal section of one-way slab showing reinforcement details. Also prepare schedule of reinforcement and quantity of steel.
2.4 Draw the details of reinforcement of two-way simply supported slab with corners not held down condition. Top and bottom plan and section along short and long spans have to be drawn. Also prepare schedule of reinforcement.
2.5 Draw the details of reinforcement of two-way simply supported slab with corners held down conditions. Top and bottom plan and section along short and long spans have to be drawn. (Scheduling of reinforcement is not necessary).
2.6 Draw the details of reinforcement of one-way continuous slab along with T-beam with details of slab and T-beam (plan and section of continuous slab and longitudinal section of T-beam have to be drawn). (Scheduling of steel is not necessary)
2.7 Draw the details of column and square footing (plan and sectional elevation) prepare schedule of reinforcement of column and footing and quantity of steel required.
2.8 Draw the reinforcement details of dog legged stair case (section only) also prepare schedule of reinforcement for one flight including landing.

3.0 Read and interpret the drawings
3.1 Take the details of reinforcement from the given drawings
3.2 Fill in the details of reinforcement in a drawing.

4.0 Draw the detailed working drawings of steel structures
4.1 Draw the sectional plan, elevation and cross section of built up beam showing the details of curtailment of plates and connection details.
4.2 Draw the details of built up column with lacing and batten system showing the details of connections by welding (plan, elevation with three systems of lacing/batten systems)
4.3 Draw the details of steel column base with details of gusset plate. Plan, section parallel to web, section parallel to flange showing the connections with welded joints.
4.4 Draw the details of Fan roof truss with angular and tubular sections along with details of connections at ridge, heel, bottom chord and roof coverings (welded connections).

4.5 Draw the details of reinforcement of frame designed as earth quake resistant structure.

COURSE CONTENT

1. a) Draw the position of columns, beams, slabs, stairs and footing in a given line diagram of building
   b) Prepare member reference scheme of given building following
      i) Column reference scheme as per IS:696 code of practice for general engineering drawing.
      ii) Grid reference scheme as per IS:5525 – recommendations for detailing of reinforced concrete works.

2. Singly reinforced simply supported rectangular beam.

3. Lintel cum sunshade.

4. Simply supported one-way slab.

5. Two-way slab simply supported corners not held down.

6. Two-way slab simply supported corners held down.

7. One-way continuous slab and T-beam (with details of slab and T-beam)

8. Column with square footing of uniform thickness.

9. Stair case – stairs spanning longitudinally (Dog legged stair case)

10. Built up beam with two cover plates with details of curtailment of plates.

11. Built up column with lacing and battening systems.

12. Gusseted column base (with welded connections),

13. Fan roof truss – 8 m span with angular and tubular sections connected by welding.

14. Frame showing the details of reinforcement for earth quake resistant structures.

REFERENCE

1. Designing and detailing hand book SP-34
PROJECT WORK

Subject Title : Project Work

Subject Code : CE-609
Periods/Week : 07
Periods/Semester : 105

OBJECTIVES

1.1 Identifies different works to be carried out in the Project.
1.2 Collects data relevant to the project.
1.3 Carries out Site Surveys.
1.4 Selects the most efficient method from the available choices based on preliminary investigation.
1.5 Designs the required elements of the project as per standard practices.
1.6 Prepares working drawings for the project.
1.7 Estimates the cost of project, men, materials and equipment required.
1.8 Prepares schedule of time and sequence of operations.
1.9 Prepares project report.
1.10 Prepares C.P.M. Chart.
1.11 Collects the requirements to start a Small Enterprise/Industry under Self Employment Scheme.
1.12 Collects the necessary information to procure necessary finance, site and equipment.
1.13 Prepares the chart or model for each project.

COURSE CONTENT

Project work is intended to provide training in the solution of field engineering problems involving Surveying, Planning, drawing plans, designing, estimating and marking out of a building/highway/irrigation/public health project. Project work will also include the preparation of the feasibility report for any one type of enterprise under self – employment schemes.

Students shall be divided into groups of five each and shall be assigned a problem that calls for application of the knowledge he/she acquired in the course and also which involves some extra study of reference materials.
Problems

a) Planning of a Campus.
b) Building project.
c) Industrial complex
d) Irrigation project.
e) Rural Water Supply Scheme.
f) Sanitary Engineering Scheme.
g) Bridge project.
h) Low Cost Housing Scheme.
i) Design of framed structure type building by using a software package.
j) Set up of a small enterprise under self employment scheme.

Every student should prepare a project report and submit the same for assessment. Every student puts his share to the work in all the operations of the project. The end examination in Project work shall consist of power point presentation and Viva-voce test to be assessed by a panel of examiners comprising of an External examiner, the Head of Section, and member of staff who guided the project as Internal examiner.

Scheme of assessment

1) Seminar - 20 Marks
2) Internal assessment - 20 Marks
3) Power point presentation & Viva – Voce - 60 Marks (3x20)

Total 100