

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

CONSTRUCTION TECHNOLOGY

SYLLABUS
(COURSE STRUCTURE-2010)

FIFTH & SIXTH
SEMESTER

CONSTRUCTION TECHNOLOGY (88)

5th Semester

Sl. No	Subject code	Name of the subject	T P C			MARKS				
						Theory		Practical		Total
						Cont. assess	Final exam.	Cont. assess	Final exam.	
1	8851	Construction Methodology -2	3	3	4	30	120	25	25	200
2	8852	Quantity Surveying-1	3	3	4	30	120	25	25	200
3	8853	Computer Aided Drawing & Drafting	1	6	3	10	40	50	50	150
4	8854	Building Facilities	2	3	3	20	80	25	25	150
5	8855	Hydrology & Water Resource Engineering	2	3	3	20	80	25	25	150
6	6454	Theory of Structure	3	3	4	30	120	25	25	200
7	5851	Book Keeping & Accounting	2	0	2	20	80	-	-	100
Total			16	21	23	160	640	175	175	1150

CONSTRUCTION TECHNOLOGY (88)

6th Semester

Sl. No	Subject code	Name of the subject	T P C			MARKS				
						Theory		Practical		Total
						Cont. assess	Final exam.	Cont. assess	Final exam.	
1	8861	Construction Methodology -3	3	3	4	30	120	25	25	200
2	8862	Quantity Surveying -2	3	3	4	30	120	25	25	200
3	6463	Design of Structure -1	3	3	4	30	120	25	25	200
4	6462	Transportation Engg-1	2	3	3	20	80	25	25	150
5	6453	Environmental Engg-1	2	3	3	20	80	25	25	150
6	5840	Environmental Management	2	0	2	20	80	-	-	100
7	5852	Industrial Management	2	0	2	20	80	-	-	100
Total			17	15	22	170	680	125	125	1100

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

CONSTRUCTION TECHNOLOGY (88)

**SYLLABUS
(COURSE STRUCTURE-2010)**

FIFTH SEMESTER

8851

CONSTRUCTION METHODOLOGY - II

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AIMS

- After completion of the course students will able to understand the construction process of different types of floor.
- After completion of the course students will able to understand the construction process of uplifting (stair, lift, Rain component of building).
- To be able to understand the construction process door, window & false ceiling roof.
- To be able to understand different finishing work in building.

SHORT DESCRIPTION

Basement floor; Ground and upper floor; Ramp; Stair; Roofs; Lime concerting; False ceiling; Doors; Windows; Plastering; Pointing; Mosaic work; Patent stone flooring; Painting; Varnishing; Damp proof work; Form Work; Joint in Structure;

DETAIL DESCRIPTION

Theory:

1 Understand the construction procedure of basement floor.

- 1.1 State the meaning of basement floor.
- 1.2 Mention the function of basement floor.
- 1.3 Name the suitable materials used for the construction of basement floor.
- 1.4 Describe the construction procedure of the basement floor.
- 1.5 Different type of damp proofing of slab.

2. Understand the construction procedure of ground floor.

- 2.1 Mention the meaning of ground floor.
- 2.2 List the components of a ground floor.
- 2.3 Mention the essential requirements of a ground floor.
- 2.4 Name the suitable materials used for the construction of ground floor.
- 2.5 Describe the construction procedure of the following type of ground floors:
 - a. Brick floor
 - b. Brick concrete floor
 - c. Terrazzo floor
 - d. Mosaic floor
 - e. Tiled floor
 - f. Marble floor
 - g. Timber floor
 - h. Plastic floor
 - i. Cork floor
 - j. Glass floor
- 2.6 Mention the factors that effect the choice of materials to construction ground floors.

3. Understand the construction procedure of upper floors.

- 3.1 Mention the meaning of upper floor.
- 3.2 Distinguish between ground floor and upper floor.
- 3.3 Mention the essential requirements of upper floors.
- 3.4 Mention the factors to be considered for the construction of upper floor.
- 3.5 Describe the construction procedure of different types of upper floors.
- 3.6 Mention the advantages and disadvantages of the followings:
 - a. Solid floor
 - b. Hollow floor

c. Composite floor.

4. Understand the construction principle of ramp.

- 4.1 State the meaning of ramp.
- 4.2 Mention the functions and location of ramp.
- 4.3 Mention the slope ratio in ramp.

5. Understand the construction principle of stairs.

- 5.1 Differentiate between stairs and staircase.
- 5.2 Mention the functions and location of stairs.
- 5.3 Define the technical terms used in stairs.
- 5.4 Name various type of steps according to shape and location.
- 5.5 Mention the relation between tread and riser.
- 5.6 Mention the relation between tread and riser.
- 5.7 List the suitable materials for construction of stairs.
- 5.8 Mention the classification of stairs.
- 5.9 Mention the suitability of each type of stair for specific use.
- 5.10 Describe a plan for a staircase of a building from a given stair hall and room height.

6. Understand the construction principles of roofs.

- 6.1 List different kind of roofs.
- 6.2 Mention the function of a roof.
- 6.3 Mention the essential requirements of a good roof.
- 6.4 Differentiate between roof structure and roof covering.
- 6.5 Define the technical terms used in roof.
- 6.6 Mention the comparison of the advantages and limitations of flat roof over pitched roof.
- 6.7 List the materials generally used for sloped roofs.
- 6.8 Mention the factors to be considered for selecting roof covering.

7. Understand the basic forms of pitched roofs.

- 7.1 Mention different types of pitched roof.
- 7.2 Describe, different types of pitched roof.
- 7.3 Describe the construction procedure of a lean to roof.
- 7.4 Distinguish between king post truss and queen post truss.
- 7.5 Mention the advantages of steel trusses over wooden trusses.

8. Understand the lime concreting.

- 8.1 State the meaning of the lime concrete.
- 8.2 Mention tie function of the line concrete.
- 8.3 Mention the advantages and limitations of LC.
- 8.4 List the properties of the materials used in LC.
- 8.5 Describe the construction procedure of LC.

9. Understand the false ceiling and slab.

- 9.1 Mention the meaning of false ceiling.
- 9.2 Describe the function of false ceiling.
- 9.3 Mention the purpose of false ceiling.
- 9.4 List the materials generally used for false ceiling.
- 9.5 Describe the advantages of false ceiling.
- 9.6 Mention the meaning of false slab.

9.7 List the materials generally used for false slab.

10. Understand the construction of doors.

- 10.1 List different types of doors.
- 10.2 Identify the technical terms used in doors.
- 10.3 Mention the factors to be considered in determining the size of doors.
- 10.4 Describe various types of doors on the basis of their suitability and uses.
- 10.5 Mention the advantages and limitation of the followings:
 - a. Panel door
 - b. Flush door
 - c. Glazed door
 - d. Louvered door
 - e. Revolving door
 - f. Sliding door
 - g. Swing door
 - h. Collapsible door
 - i. Rolling shutter door
 - j. Mild steel door
 - k. Plastic door
 - l. Aluminium door
- 10.6 Mention the general specifications for construction and workmanship of wooden frame of doors.
- 10.7 Describe the method of fixing door frames.

11. Understand the construction process of windows.

- 11.1 List different types of windows.
- 11.2 Mention the factors to be considered to determine the size, shape, location and number of windows in a room.
- 11.3 Describe various type of windows on the basis of their suitability and uses.
- 11.4 Mention the advantages and limitations of the followings:
 - a. Fixed window
 - b. Pivoted window
 - c. Sliding window,
 - d. Steel casement window,
 - e. Glazed or sash window
 - f. Louvered window
 - g. Bay window
 - h. Clerestory window
 - i. Corner window
 - j. Dormer window
 - k. Globe window
 - l. Lantern window
 - m. Aluminum window
- 11.5 Mention the functions of skylight, sunlight, fanlight and ventilator.
- 11.6 Describe the method of fixing windows.
- 11.7 Mention the comparison among the wooden, steel and aluminum glazed windows.
- 11.8 Name different types of wood joints.
- 11.9 Identify important construction joint suitable for engineering works.
- 11.10 Mention the uses of wood joint.

12. Understand the plastering and pointing.

- 12.1 State the purpose of plastering and pointing.

- 12.2 Mention the common tools for plastering works with their functions.
- 12.3 Describe the process of applying plaster on a new surface.
- 12.4 Mention the classification of plaster on the basis of their suitability and uses.
- 12.5 Mention the common defects in plastering and pointing.
- 12.6 Describe how the defects of plastering and pointing can be rectified.
- 12.7 Name the different kinds of pointing with sketches.
- 12.8 Describe the process of pointing works.
- 12.9 Distinguish between plastering and pointing.

13 Understand the mosaic works.

- 13.1 Mention the purpose of mosaic works.
- 13.2 Describe the materials used in mosaic works.
- 13.3 Describe the process of preparation of surface to be done before applying mosaic materials on floor and wall.
- 13.4 Describe the process of applying mosaic materials on floor.
- 13.5 Mention the common tools used for mosaic tools.
- 13.6 Mention the classification of mosaic.
- 13.7 Mention the common defects in mosaic works.
- 13.8 Mention how the defects of mosaic can be rectified.
- 13.9 Describe the process of preparation of surface to be done before applying tiles materials on floor and wall.

14 Understand the patent stone flooring.

- 14.1 Mention the purpose of patent stone
- 14.2 Describe the materials used in patent stone work.
- 14.3 Describe the process of preparation of surface before applying patent stone.
- 14.4 Describe the process of applying patent stone on floor on patent stone floor.
- 14.5 Describe the process of applying neat cement finishing with mix pigment on patent stone floor.
- 14.6 Mention the common tools used for patent stone flooring.
- 14.7 Mention the common defects in patent stone.
- 14.8 Mention how the defects of patent stone can be rectified.

15. Understand the process of painting.

- 15.1 Mention the purpose of painting.
- 15.2 Name the ingredients of paint.
- 15.3 Mention the specific function of each ingredient of paint.
- 15.4 Describe the characteristics of good paint. •
- 15.5 Mention the classification of paint with their suitability for use in different situations.
- 15.6 Describe the process of applying paints on new and old surface of the following:
 - a. wood surface
 - b. plaster or masonry and other absorbent surface
 - c. metal surface
- 15.7 Mention various defects in painting.
- 15.8 Describe the factors that should be considered during the supervision of quality painting work.
- 15.9 Differentiate between the properties and ingredients of the followings:

- a. white wash and color wash
 - b. distemper and snowcem wash
 - c. oil based paint and water based paint
 - d. plastic emulsion paint and synthetic enamel paint.
- 15.10 Describe the procedure of application of the following on new and old specific surfaces:
- a. white wash
 - b. color wash
 - c. distemper
 - d. snowcem (cement based paint)
 - e. plastic emulsion paint
 - f. synthetic enamel paint
 - g. weather coat paint

16. Understand the damp proof work.

- 16.1 Mention the causes of dampness in building.
- 16.2 Mention the ill effect of dampness in building.
- 16.3 Describe the method of damp proofing of building.
- 16.4 Mention the requirements of an ideal damp proofing materials.
- 16.5 Describe the damp proof course (DPC) treatment for basement and wall on undrained soil with sketchers.
- 16.6 Describe the DPC treatment for basement and wall in damp soil with sketches.

17 Understand the Joint in Structure.

- 17.1 Mention the purpose of Joining.
- 17.2 Identify different types of Joint.
- 17.3 Expansion Joints.
 - a) materials used for expansion joint.
 - b) Provision of Expansion joints in wall.
 - c) Provision of Expansion joints in roofs and floors.
 - d) Provision of Expansion joints in chajja balconics etc.
 - e) Provision of Expansion joints in verandah slab.
 - f) Provision of Expansion joints in framed structure.
- 17.4 Describe the construction procedure of the following types of joints.
 - a) Isolation joint.
 - b) Construction joints.
 - c) Sliding joints.
 - d) Floor Joints in large structure.

18 Understand the Form Work.

- 18.1 Define the form work.
- 18.2 Explain the requirements of form work.
- 18.3 List the materials generally used for form work.
- 18.4 Describe the procedure and Sketch of application of the following.
 - a. Shuttering for Columns
 - b. Shuttering for Beam and Slab Floor
 - c. Form work for stairs
 - d. Form work for walls.
- 18.5 Stripping time for Different type form work.
- 18.6 Describe the factors that should be considered during the supervision

of good quality form work.

Practical:

1 Perform the construction of one of the following floors with suitable materials:

- a. Brick floor
- b. Brick concrete floor
- c. Terrazzo floor
- d. Mosaic floor
- e. Tiled floor
- f. Timber floor
- g. RCC solid floor
- h. RCC ribbed floor

- 1.1 Select the required tools and raw materials.
- 1.2 Prepare the floor according to standard specification.
- 1.3 Clean the work site.

2 Perform a case study of dampness in building.

Identify a damped building. Investigate the reasons of dampness. Select the method of damp proofing. Estimate the materials to be needed for damp proofing.

- 4.5 Prepare a report on the specified case of dampness in building.

3 Perform the construction of the form work of a stair.

- 3.1 Collect the required tools and raw materials.
- 3.2 Draw a neat sketch of stair (at least ten nos. steps).
- 3.3 Make the bottom supports and erect inclined way.
- 3.4 Fix the steps and side of steps.
- 3.5 Check the accuracy of the works.

4 Perform the construction of a wooden lean-to-roof.

- 4.1 Collect the required tools and raw materials.
- 4.2 Draw the neat sketch with dimensions of a lean-to-roof.
- 4.3 Make the joints and assemble the members.
- 4.4 Erect the lean-to-roof in proper position.
- 4.5 Check the accuracy of the work.

5 Perform the construction of a wooden king post roof truss.

- 5.1 Collect the required tools and raw materials.
- 5.2 Draw the neat sketch with dimensions of a king post roof truss.
- 5.3 Make the joints and assemble the members.
- 5.4 Erect the king post roof truss in proper position.
- 5.5 Check the accuracy of the work.

6 Perform the construction of a wooden queen post roof truss.

- 6.1 Collect the required tools and raw materials.
- 6.2 Draw the neat sketch with dimensions of a queen post roof truss.
- 6.3 Make the joints and assemble the members.
- 6.4 Erect the queen post roof truss in proper position.
- 6.5 Check the accuracy of the work.

7 Perform cement plastering to brick walls.

Collect the required tools and raw materials.

- 7.2 Clean the loose materials from the surface.
- 7.3 Raking out all the joints upto required depth.
- 7.4 Wash the surface with water.
- 7.5 Mix(dry) cement-sand in required proportion.
- 7.6 Add water to dry mix with maintaining water-cement ratio.
- 7.7 Provide dots and check the thickness of cement plaster.
- 7.8 Provide the screed properly.
- 7.9 Apply mortar (top to bottom and left to right).
- 7.10 Plain / level the surface as possible.
- 7.11 Check the surface accordingly. •
- 7.12 Do the curing as required.

8 Perform pointing works to a boundary wall.

- 8.1 Collect the required tools and raw materials.
- 8.2 Clean the loose materials from the surface.
- 8.3 Raking out all the joints upto required depth.
- 8.4 Wash the surface with water.
- 8.5 Mix(dry) cement-sand in required proportion.
- 8.6 Add water to dry mix with maintaining water-cement ratio.
- 8.7 Apply mortar to the joints and press (top to bottom and left to right)
- 8.8 Draw the tools accordingly.
- 8.9 Check the joints accordingly.
- 8.10 Do the curing as required.

9 Perform the preparation of the detail drawing of any one of the following doors:

- a. Paneled door
- b. Glazed door
- c. Louvered door
- d. Revolving door
- e. Sliding door
- f. Swing door
- g. Collapsible door
- h. Rolling shutter door
- i. Mild steel sheet door
- j. Plastic door
- k. Aluminum door

10 Perform the preparation of the detail drawing of any one of the following windows:

- a. Fixed window
- b. Pivoted window
- c. Sliding window
- d. Casement window
- e. Glazed or sash window
- f. Louvered window
- g. Bay window „
- h. Clerestory window

- i. Corner window
- j. Dormer window
- k. Gable window
- l. Lantern window
- m. Metal window
- n. Aluminum window

11 Perform the construction of any one of the following shores:

- a. Raking shore
 - b. Flying shore
 - c. Dead shore
- 11.1 Collect the required tools and raw materials.
 - 11.2 Assemble the different members of the shore as per standard specifications.
 - 11.3 Check the stiffness / rigidity of the shore.
 - 11.4 Disassemble all the members of the shore.
 - 11.5 Store the materials used.

12 Perform the preparation of a single layer and double layers scaffolding.

- 12.1 Collect the required tools and raw materials.
- 12.2 Erect the vertical members.
- 12.3 Place the horizontal members and tied with jute rope.
- 12.4 Place the boards for platform.
- 12.5 Provide the bracings accordingly.
- 12.6 Check the properness of the scaffolding work.
- 12.7 Disassemble all the members and store the materials used.

13 Perform the preparation of form works for columns and beams.

- 13.1 Collect the required tools and raw materials.
- 13.2 Make the boards according to required size.
- 13.3 Erect the boards and attached accordingly so that they can easily remove.
- 13.4 Check the dimensions of the column / beam.
- 13.5 Disassemble the form works and store the materials used.

REFERENCE BOOKS

- 1 Building Construction
B C Punmia
- 2 A Text Book of Construction
S P Aurora & S P Bindra
- 3 Building Construction
G J Kulkarni
- 4 Building Construction
S C Rangwala
- 5. Construction Technology
j.t. Grundy volume 1 & 2

SUBJECT CODE
8852

QUANTITY SARVEYING –I

T P C
3 3 4

AIMS

- To provide the ability of quantity analysis of civil engineering works.
- To enable to estimate volume quantity of materials used in construction works.
- To provide understanding cost able to improve knowledge and skill of estimating two storied building consisting of spread footing.
- To develop skill in estimating RCC and bituminous road.
- To be able to understand the estimating of roof truss & deep tube well.
- To develop skill in rate analysis process for different items of work in the building trades.

SHORT DESCRIPTION

Introduction to estimating quantity estimation of excavating tank, road, embankment, canal digging, steps, boundary wall, bituminous & RCC road, Complete estimate of a single storied two roomed building with verandah and Two storied building with verandah, roof truss, deep tube well, Rate analysis.

DETAIL DESCRIPTION

Theory

INTRODUCTION TO ESTIMATING

1. Understand the basic concept of estimating.

Define the term estimating.

State the methods of estimating.

Mention the rules and methods of measurements of works.

Mention the rules of deduction for opening, bearing etc. in masonry.

List unit weight of different materials used in construction works.

Write unit of different items of works as per standard practice.

QUANTITY ESTIMATION

2. Estimate the volume of earth work for road work for excavating a tank.

2.1 Mention the rules of finding out the volume of earth work by mid area method.

2.2 Mention the rules finding out the volume of earth work by mean area method.

2.3 Mention the rules finding out the volume of earth work by primoidal method.

3. Estimate the volume of earth work for road embankment.

3.1 Identify the side slopes for different heights of road embankment.

3.2 Identify the cross section of road embankment.

3.3 State the method of finding out the volume of earth work in embankment by mid area method.

3.4 State the method of finding out the volume of earth work in embankment by mean area method.

3.5 State the method of finding out the volume of earth work in embankment by primoidal method.

4 Estimate the volume of earth work for canal digging.

Identify the cross section of partly banking and partly cutting.

Explain the method of finding out volume of earth work for partly banking and partly cutting.

Explain the terms lead and lift.

5 Estimate the different quantities of items of work in steps, boundary wall and roads.

Identify different parts of steps.

List different items of works in a boundary wall.

List different items of works in a bituminous road.

List different items of works in a RCC road.

COMPLETE ESTIMATE OF A SINGLE STORIED TWO ROOMED BUILDING WITH VERANDAH AND TWO STORIED BUILDING WITH VERANDAH.

6 Understand the procedure of estimating a simple building.

State center line and separate wall method.

Mention the advantage and disadvantage of center line and separate wall methods.

Explain the methods of deduction for opening or over lapping.

Define the terms sub-structure and super-structure.

Explain the dimensions length, breadth and height or depth of any section.

Identify main wall, partition wall, outer wall, inner wall, parapet wall etc.

Identify RCC work in lintel, beam, stair, floor/roof slab, sunshade, shelve, railing, drop wall etc.

List different sizes of doors and windows.

List the number of ventilators required.

Identify the items of work for civil construction.

7 Understand the estimate of roof truss (wooden & steel).

7.1 State the purpose of roof truss.

7.2 State the way of calculating the quantities of wood required in a roof truss.

7.3 State the way of calculating the quantities of steel required in a roof truss.

7.4 Mention the standard lapping at end & sides of CI sheet for roofing.

7.5 State the way of calculating the quantities of CI sheet for roof covering.

7.6 State the way of calculating the quantities of GI ridding.

7.7 State the way of calculating the painting works of roof truss.

8 Understand the estimate of sinking deep tube well.

8.1 State the meaning of deep tube well.

8.2 List the various accessories required for sinking a deep tube well.

- 8.3 Mention the different sections of a deep tube well.
- 8.4 Describe the step by step procedure reverse circulation method of sinking a deep tube well.
- 8.5 State the method of calculating the quantities of materials required for a deep tube well.
- 8.6 State the meaning of commissioning deep tube well.

RATE ANALYSIS

9 Understand the basic concept of rate analysis.

- 9.1 State meaning of rate analysis.
- 9.2 Explain the purposes of rate analysis.
- 9.3 Explain the terms, contractors profit, overhead charges, contingency sundries and lumpsum.
- 9.4 Mention the advantage of rate analysis to prepare cost estimate.

PRACTICAL

1. Calculate the volume of earth work in excavating tank of a given cross-section by mid area method.
2. Calculate the volume of earth work in excavating tank of a given cross-section by mean area method.
3. Calculate the volume of earth work in excavating tank of a given cross-section by prismoidal method.
4. Calculate the volume of earth work of 100m long embankment by mid area method.
5. Calculate the volume of earth work of 100m long embankment by mean area method.
6. Calculate the volume of earth work of 100m long embankment by prismoidal method.
7. Determine the rate of different categories of labour considering the work site including lead and lift.
8. Calculate the cost of abstract considering labour categories and lead & lifts.

9. Calculate the volume of earth work for partly banking and partly cutting.
10. Calculate the amount of cement, sand and brick, required for 10 cum masonry work using 1:4 proportion of mortar.
11. Calculate the amount of cement, sand and brick, required for 10 cum masonry work using 1:6 proportion of mortar.
12. Calculate the amount of cement, sand and brick, required for 10 sqm masonry (125mm thick wall) using 1:4 proportion of mortar.
13. Prepare an estimate for construction of underground water reservoir.
14. Prepare an estimate for construction of 100m long boundary wall.
15. Prepare an estimate for making wooden chair, table and almirah.

16. Prepare an estimate for construction of 100m long bituminous road.
17. Prepare an estimate for construction of 100m long RCC road.

18 Calculate the quantity of following items of work of a single storied two-roomed building with verandah and two storied building with verandah.

- 18.1 Earth work in excavation of foundation trenches.
- 18.2 One layer brick flat soling in foundation a floor.
- 18.3 Cement concrete work (1:3:6) in foundation a floor.
- 18.4 Brick work (1:6) in foundation (Sub-structure) up to plinth level.
- 18.5 Earth work in filling the sides of foundation trenches and plinth.
- 18.6 Damp proof course (DPC) below super structure wall.
- 18.7 Brick work (1:6) in super structure.
- 18.8 125mm thick Brick work (1:4) in partition wall.
- 18.9 RCC work (1:2:4) in lintel, beams, roof slab, strair, sunshade and drop wall.
- 18.10 Mild steel bar reinforcement fabrication in different RCC works when percentage given.
- 18.11 Wood work in door and window frames.
- 18.12 Wood work in door and window shutters.
- 18.13 Grill work for windows.
- 18.14 Pre-cast RCC ventilator.
- 18.15 Cement plaster to both sides of brick wall.
- 18.16 Cement plaster to all RCC surface.
- 18.17 Cement plaster to plinth wall and skirting with neat cement finishing (NCF).
- 18.18 Patent stone flooring (PSF).

- 18.19 Lime terracing over RCC roof slab.
- 18.20 White washing/distempering.
- 18.21 Plastic emulsion paint to walls and ceiling.
- 18.22 Color washing/snowcem washing/weather coat.
- 18.23 Synthetic enamel painting to doors and windows.

19. Prepare an estimate of a wooden truss with CI sheet roofing.

- 19.1 Select a detail drawing of a king post roof truss.
- 19.2 Determine the length & sizes of different members of the truss.
- 19.3 Calculate the quantity of wood required for the truss in cum.
- 19.4 Determine the measurements of roofing area of the truss.
- 19.5 Calculate the quantity of CI sheet roofing in bundle / sqm.
- 19.6 Calculate the quantity of GI ridging in m.
- 19.7 Calculate the quantity of painting works of the truss.

20. Prepare an estimate of a steel truss with CI sheet roofing.

- 20.1 Select a detail drawing of a steel truss.
- 20.2 Identify the length sizes & thickness of different members of the truss.
- 20.3 Determine the measurements of each of the member of the truss.

20.4 Calculate the total quantity of steel required in kilogram/quintal/ton.

20.5 Determine the measurements of roofing area of the truss.

20.6 Calculate the quantity of CI sheet roofing in bundle/ sqm.

20.7 Calculate the quantity of GI ridging in rm.

20.8 Calculate the quantity of painting works of the sleet truss.

21. Prepare an estimate for sinking a deep tube well.

21.1 List the different sections of the deep tube well.

21.2 Make a list of different accessories required at the time of sinking of deep tube well.

21.3 Identify the standard items of work for sinking a deep tube well.

21.4 Determine the necessary measurements of items of work to be done.

21.5 calculate the costing of sinking deep tube well step by step.

22. Calculate the analysis of rates for different items of building works.

REFERENCE BOOKS

1. Estimating and costing – B N Datta
2. Estimating and costing – Gurucharan Singh

Computer Aided Drawing & Drafting

8853
AIMS:

T	P	C
1	6	3

- To be able to understand Auto-CAD.
- To be able to develop skill in Auto-CAD command.
- To be able to develop knowledge, skill and attitude of applying various Auto-CAD command in architectural drafting.
- To be able to develop knowledge, skill and attitude of working drawing in Auto- CAD.
- To be able to develop knowledge, skill and attitude of drawing in Auto-CAD.

SHORT DESCRIPTION

Auto-CAD package, Command in Auto-CAD, Drawing and environment in Auto-CAD, Drawing technique of geometrical object, Editing and modifying the drawing, Text and dtext , Hatch and pan, Command dimension, Command printing and plotting, Working drawing of frame structure of multi storied residential building in Auto CAD, 3D Drawing in AutoCAD.

DETAIL DESCRIPTION

Theory:

1 Understand the Auto-CAD package.

- 1.1 Define Auto-CAD.
- 1.2 Describe the necessity of Auto-CAD in architecture and engineering field.
- 1.3 Describe how to open and exit from Auto-CAD.
- 1.4 Identify different parts of graphic window.
- 1.5 Describe the uses of different parts in graphic window.
- 1.6 Mention the uses of Icon.
- 1.7 Describe the uses of pull down menu bar.
- 1.8 Mention the uses of command in command area.
- 1.9 Describe the rectangular coordinate and polar coordinate system.
- 1.10 Describe how to find out the position of point by using rectangular and polar coordinates system.

2 Understand the environment in Auto-CAD.

- 2.1 Mention the uses of drawing aids.
- 2.2 Describe how to save the drawing environment.
- 2.3 Describe necessary command for sheet size.
- 2.4 List different system of erasing.
- 2.5 Describe necessary command for color change.

3 Understand the functions and uses of different CAD commands.

- 3.1 Mention the uses of command line and rectangle.
- 3.2 Describe the command circle, arc, donut and ellipse.
- 3.3 Describe the command pline and spline.
- 3.4 Describe the command fillet, chamfer and offset.
- 3.5 Describe the command trim, extend and break.
- 3.6 Describe the command zoom units and limits.
- 3.7 Describe the various Text command.
- 3.8 Describe the command hatch and pan.
- 3.9 Describe the command dimension.
- 3.10 Describe the command stretch, change, scale and pedit.

3.11 Describe the command printing and plotting.

4 Understand the editing and modifying the drawing.

- 4.1 Describe how to select and erase the object.
- 4.2 Describe how to duplicate the object using copy and array command.
- 4.3 Describe how to rearrange the object using move and rotate command.
- 4.4 Describe the command how to explore the object.
- 4.5 Describe the command how to mirror the object.

5 Understand the working drawing of a frame structure of multistoried Residential building in AutoCAD.

- 5.1 Describe the set up of drawing.
- 5.2 Explain the uses of symbol libraries.
- 5.3 Explain the layer selection of auto CAD.
- 5.4 Describe the uses of linetype / line selection technique in Auto CAD.
- 5.5 Describe the uses of different menu bar and tool bar for working drawing.

6 Understand the 3D Drawing in Auto CAD.

- 6.1 Mention starting command of 3D.
- 6.2 Explain how to create 3D objects / model.
- 6.3 Explain how to draw isometric view.
- 6.4 Mention the command of Edge surf and Rule surf.
- 6.5 Explain command of Tab surf and Mesh.

7 Understand the perspective view rendering, lighting and imaging in Auto CAD.

- 7.1 List the uses of co-ordinate system in Auto CAD.
- 7.2 Explain the setup of co-ordinate system in auto CAD.
- 7.3 Mention the use of surface modeling.
- 7.4 Describe how to create surface modeling.
- 7.5 Explain how to create perspective view.
- 7.6 Mention the use of distance and camera in perspective view.
- 7.7 Describe the rendering and materials effect in 3D.
- 7.8 List the uses of background in 3D.
- 7.9 Describe the setup of background in 3D.

8 Understand the plotting and printing of 3D view in Auto CAD.

- 8.1 Describe the importance of printing of 3D view.
- 8.2 Explain how to select the output format 3D.
- 8.3 Express the setup technique of printing options.
- 8.4 Describe the set up technique of plotting.

Practical:

1 Set up the drawing environment and drawing aids.

- 1.1 Start a CAD package and identify different areas of CAD screen.
- 1.2 Use the menu bar, command prompt area, toolbox, units and drawing aids.
- 1.3 Set up the drawing area and paper size.
- 1.4 Use the drawing aids.
- 1.5 Save the drawing environment.
- 1.6 Identify different menus and dialog boxes of CAD packages.
- 1.7 Exits from the CAD.

2 Perform the construction of the geometrical shape or objects.

- 2.1 Use the commands to draw lines and rectangles using polar and rectangular coordinates.
- 2.2 Create the pline and spline using single and 3D POLY commands.
- 2.3 Draw the circle, arc, dome and ellipse.
- 2.4 Connect two lines, arcs, circles with fitted arc.
- 2.5 Draw the simple construction lines.
- 2.6 Use the command for freehand sketches.

3 Edit and modify the objects.

- 3.1 Select and erase the objects using different technique.
- 3.2 Duplicate the objects using copy/grips, offset, mirror and array command.
- 3.3 Rearrange the objects using move and rotate commands.
- 3.4 Resize the objects using stretch, scale, extend, trim and length commands.
- 3.5 Break the objects.
- 3.6 Explore the objects.
- 3.7 Chamfer and fillet the objects.

4 Setup the dimension of the drawing.

- 4.1 Use the commands to set up the dimension variables and scale.
- 4.2 Create the linear, angular, diameter, radius and ordinate dimensions.
- 4.3 Dimension the multiple objects.
- 4.4 Edit the dimensions.
- 4.5 Create the leads and annotations.

5 Organize the drawing information on layers.

- 5.1 Identify the layer control options.
- 5.2 Create and name the layers.
- 5.3 Make the layer current and control layer visibility.
- 5.4 Freeze, lock and unlock the layers.
- 5.5 Set the layer color and line type.

6 Display and view the drawing.

- 6.1 Redraw and regenerate a drawing.
- 6.2 Move around within a drawing using pan and zoom command.
- 6.3 Change the magnification of the drawing using zoom in/out/all etc.
- 6.4 Use the aerial view, named view and multiple view ports.

7 Fill the drawing area with hatch patterns.

- 7.1 Identify the hatch patterns with CAD.
- 7.2 Add the default hatch pattern area of a drawing.
- 7.3 Create the custom hatch patterns.
- 7.4 Control the appearance (i.e. size or scale) of the hatch patterns.
- 7.5 Select or define the hatch boundaries.

8 Work with the text.

- 8.1 Create the line text.
- 8.2 Create the paragraph text.
- 8.3 Edit and change the text.
- 8.4 Check the spelling.
- 8.5 Insert the text from the outside of CAD.
- 8.6 Work with the text style.

9 Perform the preparation of working drawing of multistoried residential Building.

- 9.1 Use the menu bar, command prompt area, toolbox, units and drawing aids.
- 9.2 Set up the drawing area and paper size.
- 9.3 Draw ground floor plan with all dimensions in different layer.
- 9.4 Draw typical floor plan with all dimensions in different layer.
- 9.5 Draw front and side elevations using different layer linetype color and hatch.
- 9.6 Draw section through staircase with all detail dimensions.

10 Perform the preparation of detail architecture drawing of multi-stroied Residential building.

- 10.1 Draw detail toilet plan using different layer, fine type and color.
- 10.2 Draw detail section of toilet.
- 10.3 Draw detail kitchen plan using different layer, line type and color.
- 10.4 Draw detail section of kitchen.
- 10.5 Draw detail plan of a locker.
- 10.6 Draw detail section of a locker.

11 Perform the preparation of detail structural drawing of multi storied residential building.

- 11.1 Draw the detail plan and section of independent column footing.
- 11.2 Draw the detail long and cross section of rectangular beam.
- 11.3 Draw the detail plan and section of one way slab using different layer line type and color.
- 11.4 Draw the detail plan and section of two slab using different layer, line type and color.
- 11.5 Detach the rainforcement detail of stair.
- 11.6 Print the drawing.

12 Prepare 3D object in Auto CAD.

- 12.1 Create simple object in Auto CAD.
- 12.2 Draw isometric view using snap and Isoplane command.
- 12.3 Create 3D surface by using 3D poly, Edge surf, Rule surf, Tab surf and Mesh.
- 12.4 Edit / draw 3D object using polar co-ordinate system.
- 12.5 Edit 3D object different editing command i. e. align, rotate 3D, array 3D, Mirror 3D, move, chamfer, fillet, trim etc.

13 Prepare Building Plan By Using Auto-CAD.

- 13.1 Prepare a multi storied Building Plan by Using Auto-CAD.
- 13.2 Convert the Building plan in 13.1 into 3D.

REFERENCE BOOK:

1. **Auto-CAD 2000 / Auto CAD 2001 – Engr. Md. Shaha Alam.**
2. **Mastering AutoCAD 2008 - Engr. Samuel Mallik**
3. **Mastering AutoCAD - George Omura**

AIMS

- After completion of the course students will be able to understand various facilities to be required in a building.
- To be able to assist in comparing various types of water pipes and pipe fitting.
- To be able to develop understanding of the procedure of construction, repair, Replacement and maintenance of water supply and sanitary systems.
- To be able to develop understanding of the procedure of construction and Maintenance of hot and cold water supply.
- To be able to develop understanding of the procedure of construction, repair, replacement and maintenance of gas supply, ventilation and air-conditioning, electric facilities and fire fighting and fire protection system.
- To be able to develop understanding of the car parking system in building.
- To be able to develop understanding of the necessity of lift, escalator and building security
- To be able to develop understanding of the Heat and Sound insulation in building.
- To be able to develop understanding of the multi-dimensional facilities in building.

SHORT DESCRIPTION

Types of building facilities; Water supply and sanitary systems for building; Gas supply; Electric facilities; Building security system; (Alarming system CCTV); Air conditioning and cooling system; Parking system; Heat and sound insulation; Lift and escalator; Fire fighting and extinguishing; communication system (CAVT, telephone, Intercom); multi-dimensional facilities.

DETAIL DESCRIPTION

Theory:

TYPES OF BUILDING FACILITIES

- 1 Understand different building facilities.**
 - 1.1 Define building facilities.
 - 1.2 List the types of Building.

- 1.3 Mention different building facilities.
- 1.4 Explain the necessity of different facilities in building.
- 1.5 Describe the scope of building facilities.

WATER SUPPLY AND SANITARY SYSTEM IN BUILDING

2 Understand water supply and sanitary system.

- 2.1 Define plumbing system.
- 2.2 Water distribution system in building.
- 2.3 Explain the requirements of water supply and sanitary system.
- 2.4 Draw the house drainage plane for efficient drainage.
- 2.5 Identify various water supply and sanitary fittings and fixtures with sketches.
- 2.6 Describe various water supply and sanitary fittings and fixtures.
- 2.7 Differentiate between plumbing fittings and fixtures.
- 2.8 List the tools required for plumbing works.
- 2.9 Explain the system of plumbing.
- 2.10 Explain the service connection and size of service pipe.
- 2.11 Mention the uses and maintenance of various water supply and sanitary tools.

3 Understand water supply and sanitary system in building.

- 3.1 Identify the following in water supply system.
 - (i) Water main
 - (ii) Goose neck
 - (iii) Water meter
 - (iv) Service pipe
 - (v) Stake
 - (vi) Branch
- 3.2 Describe underground water reservoir.
- 3.3 Explain roof top water tank.
- 3.4 Identify the following in sanitary system:
 - (a) Rain water down pipe
 - (b) Soil pipe
 - (c) Vent pipe
 - (d) Cowel
- 3.5 Describe with sketches the followings:
 - (a) Inspection pit
 - (b) Septic tank
 - (c) Soak well

4 Understand Hot and Cold water supply in Building (Dual Supply System).

- 4.1 Define hot and cold water supply system.
- 4.2 List the types of system.
- 4.3 Describe the direct and indirect cold-water system.
- 4.4 Describe the direct and indirect hot-water system.
- 4.5 Describe with sketches the followings:

- (a) Water-storage cistern.
- (b) Indirect hot-water cylinders.
- 4.6 Differentiate between single and dual supply system.

GAS SUPPLY SYSTEM

5 Understand the gas supply in building.

- 5.1 Describe gas main.
- 5.2 Explain the connection procedure of service pipe with gas main.
- 5.3 List the tools required for gas supply.
- 5.4 Describe with sketch the gas meter.
- 5.5 Identify the fittings required for gas supply.
- 5.6 Distinguish between pipe lines supply and gas cylinder supply.
- 5.7 Explain the importance of bio-gas plant system in Bangladesh.
- 5.8 Describe the safety required for gas supply and consume.

6 Understand gas stoves.

- 6.1 Describe with sketch different types of gas stoves.
- 6.2 Explain the connection procedure of gas stove with supply line.
- 6.3 List different types of gas pipe and valve.
- 6.4 Explain the ignition system of gas stoves.
- 6.5 Describe the procedure of repair and maintenance of gas stoves.

ELECTRIC SUPPLY

7 Understand the electric facilities in building.

- 7.1 Mention the history and definition of electricity.
 - 7.2 Describe with proper solution the followings:
 - (i) Load shedding
 - (ii) Short circuit
 - (iii) Over load
 - (iv) High and low voltage
 - 7.3 Define nonstop electricity supply.
 - 7.4 Describe the necessity of nonstop electricity supply.
 - 7.5 Describe with importance and limitation the followings:
 - (i) IPS
 - (ii) Generator
 - (iii) Power plant
 - 7.6 Explain the power supply unit.
 - 7.7 Three-phase electric power supply.
 - 7.8 Explain the advantage of three-phase electric power supply system.
- ### **8 Understand the solar electricity used in building.**
- 8.1 Define solar electricity.
 - 8.2 List the materials required for solar system.
 - 8.3 Mention the application of solar technology.
 - 8.4 Mention the advantages, disadvantages & limitations of solar electricity.

8.5 Mention the uses of solar electricity in residential building and commercial space.

8.6 Describe the necessity of solar electricity system in Bangladesh.

BUILDING SECURITY SYSTEM

9 Understand the building security system.

9.1 Define building security.

9.2 List different types of building security system.

9.3 Explain the necessity of building security.

9.4 Describe the close circuit television as a security device.

9.5 Mention the use of remote control lock as a security device.

9.6 Explain how the alarming devices help to secure the house.

VENTILATION AND AIR CONDITION

10 Understand ventilation in building.

10.1 Define ventilation.

10.2 State the necessity of ventilation.

10.3 Functional requirements of ventilation system.

10.4 Explain the natural ventilation.

10.5 Explain the mechanical ventilation.

11 Understand air conditioning in building.

11.1 Define air conditioning.

11.2 Describe the necessity of air conditioning in building.

11.3 Name different elements of an air-conditioning unit suitable for use in all weather.

11.4 Mention different types of air conditioner.

11.5 Describe the suitable location of different air conditioners.

11.6 Explain the heat load and cooling load of a building.

11.7 List the factors that influence the summer and winter air conditioning.

11.8 Explain how to maintain conformable condition of efficient working.

LIFT AND ESCALATOR

12 Understand lift and escalator.

12.1 Define lift and escalator.

12.2 Describe the necessity of using lift and escalator in building.

12.3 Describe different types of passenger lift.

12.4 Mention the engineering specification of a passenger lift and escalator.

12.5 Explain the operation principle of:

(i) Lift

(ii) Escalator

12.6 Describe the repair and maintenance of lift and escalator.

COMMUNICATION SYSTEM

13 Understand the communication system in building.

- 13.1 Explain the importance of communication system in building.
- 13.2 State different types of communication system required in building.
- 13.3 Describe the importance of the followings in building:
 - (i) CATV
 - (ii) CC TV
 - (iii) Telephone
 - (iv) Intercom.

14 Understand the parking system in building.

- 14.1 Define parking garage.
- 14.2 Suitable place for parking garage.
- 14.3 Explain the necessity of parking garage in building.
- 14.4 Describe the following:
 - (i) Basement parking garage.
 - (ii) Underground parking garage.
 - (iii) Multi-storey parking garage.
- 14.5 Distinguish between Basement and Underground parking garage.
- 14.6 Parking control.

BUILDING INSULATION

15 Understand the thermal insulation in building.

- 15.1 Define thermal insulation.
- 15.2 Advantage of thermal insulation.
- 15.3 Explain the heat transfer with basic definition.
- 15.4 Thermal insulation materials.
- 15.5 Effect of solar radiation in building.
- 15.6 Process of protecting building from solar radiation.
- 15.7 General methods of thermal insulation.
- 15.8 State the thermal insulation of followings:
 - (i) Roof
 - (ii) Exposed walls
 - (iii) Exposed doors

16 Understand the acoustics and sound insulation

in building.

- 16.1 Explain acoustics.
- 16.2 State the followings:
 - (i) Frequency of sound
 - (ii) Wave length of sound
 - (iii) Velocity of sound
 - (iv) Propagation of sound.
- 16.3 State sound absorption.
- 16.4 State the followings acoustical defects:
 - (i) Reflection
 - (ii) Reverberation
 - (iii) Formation of echoes
 - (iv) Focus point
 - (v) Dead spots

- (vi) Loudness
- (vii) Noise
- 16.5 General principles and factors in acoustical design.
- 16.6 State sound insulation.
- 16.7 Describe the process of sound insulation.
- 16.8 Difference between sound absorption and sound insulation.

FIRE PROTECTION, FIRE FIGHTING AND EXTINGUISHING

17 Understand fire protection.

- 17.1 State the meaning of fire protection.
- 17.2 Explain the terms fire resistance.
- 17.3 Fire resistance construction.
- 17.4 Explain the necessity of fire alarms in any building.
- 17.5 List the fire extinguishing equipments.

18 Understand fire fighting and extinguishing.

- 18.1 State the meaning of fire fighting and extinguishing.
- 18.2 Describe the measures to be taken when a building on fire.
- 18.3 Explain the security measures to be taken in a building to safe from fire.
- 18.4 Explain the necessity of safe fire exit in building.
- 18.5 List the fire fighting tools and requirement.
- 18.6 Describe the operation of fire fighting extinguisher.

MULTIDIMENSIONAL FACILITES

19 Understand multi-dimensional facilities in future building.

- 19.1 State the meaning of multi-dimensional facilities in building.
- 19.2 Describe different types of multi-dimensional facilities.
- 19.3 Mention the advantages of multi-dimensional facilities.
- 19.4 State the meaning of ultra modern facilities.
- 19.5 Mention different types of ultra modern facilities.
- 19.6 Explain the necessity of ultra modern facilities in building.

Practical:

- 1 Perform the identification of pipes and fittings for**

water and gas supply.

- 1.1 Identify physically different types of pipes fittings and joints.
- 1.2 Draw sketches of typical plumbing and gas fittings.
- 1.3 Cut pipes and cut a thread on the pipe.
- 1.4 Inspect installations to identify good and poor quality materials and workmanship.

2 Perform the maintenance works.

- 2.1 Identify, take out and replace unserviceable fixtures / fittings or any other component parts.
- 2.2 Identify the common troubles of water pumps and solve the problems.
- 2.3 Identify the common troubles in water supply pipe lines and solve the problems.

3 Sketch different types of plumbing fixtures.

- 3.1 Draw sketches of water closet suite which includes a commode, flushing cistern and connecting pipe etc, showing necessary dimensions.
- 3.2 Draw the sketches of bath tub, shower bath, urinals, lavatory or wash basin, sink, laundry tray, drinking fountain etc, showing dimensions including their levels.
- 3.3 Draw the sectional view of an automatic flushing tank with a flush valve and indicate individual name of each part.

4 Sketch manhole and septic tank.

- 4.1 Draw the plan views and detail sectional views of manhole, septic tank and soak pit indicating the individual parts.
- 4.2 Indicate the dimensions of manhole, septic tank and pit.

5 Perform the connection of different sanitary fixtures.

- 5.1 Select tools, equipment and necessary materials required to connect sanitary fixtures.
- 5.2 Arrange support for fixtures, make proper level and install the fixtures giving required connections for use.

6 Perform the replacement of unserviceable sanitary fixtures.

- 6.1 Apply correct methods for repairing and replacing unserviceable sanitary fixtures.
- 6.2 Select proper tools and equipment and materials needed for repairing

- 6.3 unserviceable fixtures.
- 6.3 Detect the defect of fixtures and refix it..
- 7 Perform the connection system of gas supply**
 - 7.1 List the hand tools used in gas supply system.
 - 7.2 perform connection between pipe lines and gas cylinder.
 - 7.3 Identify the common troubles in gas supply pipe lines and solve the problems.
- 8 Perform the solar electricity system.**
 - 8.1 Field visit solar electricity plant .
 - 8.2 perform a solar system model.
 - 8.3 Make the joints according to sketches.
 - 8.4 Write a report.
- 9 Visit a fire service and civil defense station.

REFERENCE BOOKS

1. A Test book of Electrical Technology
- B. L. Theraja.
2. Water Supply and Sanitary System
- Aziz and Shahjahan
3. Environmental technology in architecture
- by Kinzey and Sharp

AIMS:

- After completion of the course students will be able to understand the influence of the climatic condition of Bangladesh on its ground water and surface water flow;
- After completion of the course students will be able to understand the basic principle of geomorphology as it applies to Bangladesh;
- To be able to compare various means of lifting underground water and to select appropriate means for given situation
- To be able to select a suitable source of water and method of irrigation for particular situation;
- To be able to select a suitable method for control of rivers and flood in Bangladesh.

SHORT DESCRIPTION

Sources of water; Rainfall and run-off; Geomorphology; Lifting of underground water; Methods of irrigation; Storage reservoir; Dam and dyke; Irrigation canals; Reclamation of salt affected water logged land; River training works; Flood and flood control.

DETAIL DESCRIPTION**Theory:****1 Understand different sources of water.**

1.1 Explain with neat sketch the hydrological cycle.

1.2 Explain the meaning of the following:

- a) rainfall
- b) rainfall intensity and duration frequency relationship
- c) run-off
- d) infiltration
- e) evaporation
- f) transpiration
- g) evapo-transpiration
- h) permeable and impermeable strata of soil
- i) ground water table
- j) precipitation
- k) aquifer

1.3 Mention the classification of the sources of water (surface water and ground water).

2 Understand the characteristics of rainfall and run-off in Bangladesh.

2.1 Mention the characteristics of rainfall and run-off in Bangladesh.

2.2 Describe with sketches the various types of rain gages.

2.3 List the factors affecting the run-off area.

2.4 Determine the average annual run-off of a catchment area from given data.

2.5 Identify the components of storm hydrograph.

2.6 Explain with sketches the construction of unit hydrograph.

3 Understand the concepts of geomorphology.

3.1 State the meaning of geomorphology.

3.2 Mention the principles of geomorphology as it applies in Bangladesh.

4 Understand the technique of lifting underground water.

4.1 Explain with sketch the meaning of :

- a) shallow well
- b) deep well
- c) artesian well
- d) spring well

4.2 Differentiate between shallow well and deep well..

4.3 List different boring systems of tube well.

4.5 Necessity of test boring for drinking water lifting :

- a) Performing the test boring & testing the portability of water
- b) Determining strainer size & length
- c) Aquifer depth determination

- d) Specific yield.
- e) Effective size of the soil particle of the aquifer
- f) Influence area.
- g) Boring of production well
- h) Lowering of Pipes and strainer
- j) Determining the capacity of well

4.6 Point out the difficulties in tube well boring.

4.7 Describe the remedies of difficulties during tube well boring.

5 Understand the application of centrifugal pumps and turbine pumps.

5.1 Distinguish between the centrifugal pumps and turbine pumps.

5.2 Explain the suction and discharge capacity of a centrifugal pump.

5.3 Mention the factors to be considered for selecting pumps.

5.4 Determine work, power and efficiency of a pump under given conditions.

5.5 Mention the installation procedures of centrifugal pumps.

5.6 Mention the procedures of maintenance & repair of centrifugal pumps and turbine pumps.

6 Understand the concepts of dewatering.

6.1 State the meaning of dewatering.

6.2 Mention the situations when dewatering is required.

6.3 Describe the methods with sketches of dewatering based on situations.

6.4 Mention the advantages of dewatering regarding construction works.

7 Understand the different methods of irrigation.

7.1 Name different types of irrigation including sub-divisions.

7.2 Describe flow irrigation including sub-divisions.

7.3 Distinguish between perennial and inundation irrigation.

7.4 Differentiate canal or direct irrigation with reservoir (tank) or indirect irrigation.

7.5 Describe the relation of natural and artificial irrigation.

7.6 Mention the advantages of natural irrigation.

7.7 Mention the disadvantages of natural irrigation.

7.8 State the meaning of lift irrigation.

7.9 Describe different methods for lifting water for irrigation manually and by power.

8 Understand the concept of water requirement for crops.

8.1 State the meaning of water requirement for crops.

8.2 Define the terms duty, delta, base period and crop period.

8.3 Express the relation among duty, delta and base period.

8.4 Mention the factors for improvement of duty of water for irrigation.

8.5 Solve problems on duty, delta and base period.

8.6 Determine size and power of pump required for irrigation of a particular area.

8.7 Explain the various methods of applying irrigation water to the land.

9 Understand the concept of storage reservoirs.

9.1 State the meaning of storage reservoir.

9.2 Explain the necessity of storage reservoir

9.3 Mention the requirements of an ideal reservoir.

9.4 Describe the distribution of water from reservoir to land through different canals.

9.5 Explain the meaning of commendable area and irrigable area.

9.6 Find the capacity of a storage reservoir by using appropriate methods.

9.7 Mention the factors that determine the height of the dam of a reservoir.

9.8 Mention the section of a dam of reservoir with different components.

10 Understand the features of a dam.

10.1 State the meaning of dam.

10.2 Give classification of dam (rigid and non-rigid).

10.1 Mention the classification of earthen dam.

- 10.3 Mention the favorable conditions for location of an earthen dam.
- 10.4 Mention the favorable conditions for location of a masonry dam.
- 10.5 Mention the advantages and disadvantages & limitations of an earthen dam.
- 10.6 Mention the advantages and disadvantages of masonry dam.
- 10.2 Describe drainage system under a dam.
- 10.3 Mention the term core wall and line of saturation with sketches.
- 10.4 Describe the construction procedure of an earthen dam.
- 10.5 Mention the causes of failure of an earthen dam.
- 10.6 Mention the remedies for preventing the failure of an earthen dam.

11 Understand the features of a dyke.

- 11.1 Mention the meaning of dyke.
- 11.2 Differentiate between dam and dyke.
- 11.3 Describe the construction procedure of a dyke.
- 11.4 List the causes of failure of a dyke.
- 11.5 Mention the remedies for preventing the failure of a dyke.
- 11.6 State the functions of core wall.
- 11.7 Mention the factors to be considered in determining the location of core wall.
- 11.8 State the meaning of barrage, weir and spillway.

12 Understand different types of irrigation canals.

- 12.1 State the meaning of main, branch, distributaries and field canal.
- 12.2 Mention the points to be considered in fixing the alignment of an irrigation canal.
- 12.3 Mention the factors to be considered for designing an irrigation canal.
- 12.4 Describe with sketches the distributaries system of irrigation canals.

13 Understand the principles of reclamation of salt affected water logged land.

- 13.1 State the meaning of land reclamation.
- 13.2 Explain the necessity of land reclamation.
- 13.3 Mention the steps for reclamation of salt affected land.
- 13.4 State the meaning of water logging.
- 13.5 Mention the effects of water logging.

14 Understand the causes of silt deposition.

- 14.1 State the meaning of silt and silt ration.
- 14.2 Mention the causes of silt ration.
- 14.3 State the meaning of scouring.
- 14.4 Mention the causes of scouring.

15 Understand the necessity of river training works.

- 15.1 State the meaning of river training & river training head works.
- 15.2 Name the different components of a head works.
- 15.2 Outline the object of river training.
- 15.3 Mention different methods of river training works.
- 15.4 Mention the functions of guide bank, groyne, spur, afflux, marginal bund and stone apron.
- 15.5 Explain the necessity of river training works in Bangladesh.

16 Understand the concept of flood and flood control.

- 16.1 State the meaning of flood.
- 16.2 Mention the causes of flood.
- 16.3 Mention different methods of controlling flood.
- 16.4 Specify the causes of flood in Bangladesh.
- 16.5 Describe the suitable method(s) for flood control in Bangladesh.
- 16.6 Understand the principles of construction, repair and maintenance works of different structures for irrigation and flood control.

Practical:

1. Measure rainfall by rain gage and determine the intensity of rainfall.
2. Draw neat sketch of cone of depression with draw down and circle of influence
3. Perform tube well boring.
4. Draw the section of a dam of a reservoir with components.
5. Draw neat sketches of the location of a weir, barrage, spillway and sluice gate.
6. Prepare a model for a typical irrigation project.
7. Prepare a model for a typical drainage project.
8. Prepare a model for a typical flood control project.
9. Visit an irrigation project in Bangladesh and write a report.
10. Visit a drainage project in Bangladesh and write a report.
11. Visit a flood control project in Bangladesh and write a report.
12. Visit any multipurpose project in Bangladesh and write a report.

REFERENCE BOOKS

- 1 Hydrology
– Raghunath
- 2 Irrigation Engineering and Hydraulic structure
– Santosh Kumar Garg
- 3 Introductory Irrigation
– B C Punmia
- 4 Irrigation
– Esrailson

AIMS

- To be able to consolidate and extend the fundamental understanding of the behavior of statically determinate structures i.e. beams, frames etc.
- To be able to develop awareness of structural behavior such as deflection and stability of masonry dam.
- To be able to develop understanding for selection of suitable section of beam and member of the truss.

SHORT DESCRIPTION

Shear force and bending moment of beams; Stresses in beams; Deflection of beams; Joints and connections; Forces in frames; Masonry dam; Column; Moving loads; Thin Cylindrical shells.

DETAIL DESCRIPTION**Theory:****1 Understand shear force and bending moment of beams.**

- 1.1 State different type of loads on beam.
- 1.2 Mention different types of support condition.
- 1.3 Define point of contraflexure or inflection point.
- 1.4 Define dangerous section
- 1.5 Explain the relations between shear force and bending moment.
- 1.6 Characteristics of SF and BM diagrams.
- 1.7 Solve problems on SF and BM of cantilever beam with concentrated load, distributed load, inclined load, couples, pure moment and combined loads.
- 1.8 Solve problems on SF and BM of simply supported beam with concentrated load, distributed load, inclined load, couples, pure moment and combined loads.
- 1.9 Solve problems on SF and BM of overhanging beam with concentrated load, distributed load, inclined load, couples, pure moment and combined loads.
- 1.10 Solve problems on SF and BM diagram to loading diagram of cantilever, simply supported and overhanging beams.

2 Understand the bending (flexural) stresses in beams.

- 2.1 State the meaning of bending stresses in beam.
- 2.2 List the assumptions of bending stresses in beam.
- 2.3 Differentiate between bending moment and bending stress.
- 2.4 Express and derivation of the formula for bending stress.
- 2.5 State the meaning of elastic section modulus.
- 2.6 Solve problems on bending stresses of circular, rectangular, I, T, L and hollow sections of beams.
- 2.7 Solve problems on section modulus of circular, rectangular, I, T, L and hollow sections of beams.

3 Understand the shearing stresses in beams.

- 3.1 State the meaning of shearing stresses in beam
- 3.2 Differentiate between maximum and average shear stress.
- 3.3 Relate maximum shear stress and average shear stress for rectangular, circular and triangular section.
- 3.4 Express the derivation of the formula for shearing stress.

- 3.5 Solve problems on shearing stresses of circular, rectangular, I , T, L and hollow sections of beams.
- 3.6 Determine the section of homogeneous beam with respect to shearing stress and bending stress.

4 Understand the deflection of beams.

- 4.1 Define the meaning of deflection of beam and elastic curve.
- 4.2 List the assumptions of deflection of beam.
- 4.3 State the maximum allowable deflection for beam, RCC slab and steel trusses.
- 4.4 Express the derivation of equation for elastic curve
- 4.5 State the 1st and 2nd area moment proposition.
- 4.6 Compute the slope of elastic curve for cantilever beam with concentrated and distributed load.
- 4.7 Compute the maximum deflection for cantilever beam with concentrated and distributed load.
- 4.8 Compute the slope of elastic curve for simply supported beam with symmetrically concentrated and distributed load.
- 4.9 Compute the maximum deflection for simply supported beam with symmetrically concentrated and distributed load.
- 4.10 Compute the maximum deflection for simply supported beam with unsymmetrical concentrated load.

5 Understand the importance of joints.

- 5.1 Define joint, pitch, back pitch and repeating section.
- 5.2 State the necessity of joints.
- 5.3 Mention the classification of joints.
- 5.4 State the meaning of efficiency of joints.
- 5.5 Explain the modes of failure and remedial measures of riveted joints.
- 5.6 Solve problems on simple lap joint subjected to axial load only.
- 5.7 Solve problems on butt joint subjected to axial load only.

6 Understand the significance of welded connections.

- 6.1 Define terms: Leg, Throat, Fillet, Reinforcement etc.
- 6.2 State the significance of welded connections.
- 6.3 Classify different types of welded connections.
- 6.4 Mention the merits of welded connections.
- 6.5 Mention the demerits of welded connections.
- 6.6 Distinguish between joints and connections.
- 6.7 Solve problems on butt weld connection subjected to axial load only.
- 6.8 Solve problems on fillet weld connection subjected to axial load only.

7 Understand the action of forces in frames.

- 7.1 Define the terms: truss, tie, strut, perfect, imperfect, deficient, redundant, web and chord member.
- 7.2 Mention different types of roof trusses and bridge trusses.
- 7.3 State the fundamental assumptions in trusses.
- 7.4 Describe the methods of computing forces in trusses.
- 7.5 Determine the forces on frames for warren truss, cantilever, jib crane and howe truss with dead load by Analytical (joint and moment method) and Graphical method.

8 Understand the stability of masonry dam.

- 8.1 Define dam and mention the functions of a dam.
- 8.2 Mention the different types of dam.
- 8.3 Explain the stability of a masonry dam.

- 8.4 State the meaning of middle third law.
- 8.5 Express the derivation of the equation for minimum width of the base for just no tension.
- 8.6 Calculate the maximum and minimum pressure on the foundation bed for rectangular dam
- 8.7 Calculate the maximum and minimum pressure on the foundation bed for trapezoidal dam having water face vertical only.
- 8.8 Solve problems on stability and suitable section of the dam.

9 Understand the elastic buckling of columns.

- 9.1 State the meaning of short and long column.
- 9.2 Mention the type of columns on the basis of end conditions.
- 9.3 Compare the equivalent length of different columns.
- 9.4 Express the derivation of the Euler's formula for flexural buckling of a pin ended strut/column.
- 9.5 Calculate the safe load on column using Euler's formula.
- 9.6 State the Rankine-Gordon formula.
- 9.7 Calculate the safe load on column using Rankine-Gordon formula.

10 Understand the concept of moving loads.

- 10.1 State the meaning of moving load.
- 10.2 Classify different types of moving loads.
- 10.3 State the meaning of influence line.
- 10.4 Draw influence line for single concentrated load and reaction of a beam.

11. Understand the concept of Thin Cylindrical Shells.

- 11.1 Introduction.
- 11.2 Failure of a cylindrical shell due to an internal pressure.
- 11.3 Stresses in a thin cylindrical shell.
- 11.4 Circumferential stress.
- 11.5 Longitudinal stresses.
- 11.6 Design of thin cylindrical shells

Practical:

- 1 Determine shear force & bending moment at different sections of simply supported beam with different types of load and draw the diagrams.
- 2 Determine shear force & bending moment at different sections of over hanging beam with different types of load and draw the diagrams.
- 3 Determine the position of dangerous section and inflection point or point of contra flexure of over hanging beam.
- 4 Determine the bending stresses of circular, rectangular, I , T , L & hollow sections of beams and draw the diagrams.
- 5 Determine the shearing stresses of circular, rectangular, I , T , L & hollow sections of beams and draw the diagrams.
- 6 Determine the section modulus of circular, rectangular, I , T , L & hollow sections of beams and draw the diagrams.
- 7 Determine the section of homogeneous beam with respect to shearing stress and bending stress.
- 8 Determine the deflection of cantilever and simply supported homogeneous beam with respect to concentrated and distributed load.
- 9 Draw the neat sketches of different type of riveted joints and welded connections showing the mode of failures.
- 10 Determine the forces developed on the member of a truss graphically.
- 11 Prepare some models of different types of truss with suitable materials.
- 12 Determine the buckling load of both ends fixed homogeneous column.

REFERENCE BOOKS

2. Theory of simple structure
 - T C Shed and J Vawter
2. Strength of materials and structures
 - J Case and A H Chilver
3. Theory of structures
 - R S Khurmi
4. Strength of Materials
 - R S Khurmi

5851 BOOK KEEPING & ACCOUNTING

T	P	C
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AIMS

- To be able to understand the principles and practices of book keeping and accounting.
- To be able to understand the procedures of general accounting, financial accounting and their applications.

SHORT DESCRIPTION

Concept of book keeping and accounting; Transactions; Entry systems; Accounts; Journal; Ledger; Cash book; Trial balance; Final accounts; Cost account & financial accounting; Depreciation; Public works accounts.

DETAIL DESCRIPTION**1 Understand the concept of book keeping and accounting.**

- 1.1 Define book keeping and accountancy.
- 1.2 State the objectives of book keeping.
- 1.3 State the advantages of book keeping.
- 1.4 Differentiate between book keeping and accounting.
- 1.5 State the necessity and scope of book keeping and accounting.

2 Understand the transactions.

- 2.1 Define transactions and business transaction.
- 2.2 Explain the importance of transactions.
- 2.3 Describe the characteristic features of transactions.
- 2.4 Discuss the classification of transaction.
- 2.5 Identify the transaction from given statements stating reasons.

3 Understand the entry system.

- 3.1 State the aspects of transactions.
- 3.2 Define single entry system.
- 3.3 State the objectives of single entry system.
- 3.4 Discuss the disadvantages of single entry system.
- 3.5 Define double entry system.
- 3.6 Discuss the principles of double entry system.
- 3.7 Justify whether double entry system is an improvement over the single entry system.
- 3.8 Distinguish between single entry and double entry system of book keeping.

4 Understand the classification of accounts.

- 4.1 Define accounts.
- 4.2 State the objectives of accounts.
- 4.3 Illustrate different type of accounts with example.
- 4.4 Define "Golden rules of Book keeping".
- 4.5 State the rules for "Debit" and "Credit" in each class of accounts.
- 4.6 Determine Debtor (Dr) and Creditor (Cr.) from given transactions applying golden rules.
- 4.7 Define accounting cycle.
- 4.8 State the different steps of accounting cycle.

5 Understand the Journal.

- 5.1 Define Journal.
- 5.2 State the object of Journal.

- 5.3 State the functions of Journal.
- 5.4 Mention the various names of Journal.
- 5.5 Interpret the form of Journal.
- 5.6 Journalize from given transactions.

6 Understand the ledger.

- 6.1 Define ledger.
- 6.2 Interpret the form of ledger.
- 6.3 State the functions of ledger.
- 6.4 Distinguish between Journal and Ledger.
- 6.5 Prepare ledger from given transactions.
- 6.6 Explain why ledger is called the king of all books of accounts.

7 Understand the cash book.

- 7.1 Define cash book (single, double and triple column).
- 7.2 Explain cash book as both Journal and Ledger.
- 7.3 Prepare double column cash book from given transactions showing balances.
- 7.4 Prepare triple column cash book from given transaction and find out the balances.
- 7.5 Define petty cash book.
- 7.6 Prepare analytical and imprest system of cash book.
- 7.7 Define discount.
- 7.8 Explain the different types of discount.

8 Understand the trial balance.

- 8.1 Define trial balance.
- 8.2 State the object of a trial balance.
- 8.3 Discuss the methods of preparation of a trial balance.
- 8.4 Explain the limitations of a trial balance.
- 8.5 Prepare trial balance from given balance.

9 Understand the final accounts.

- 9.1 State the components of final account.
- 9.2 Distinguish between trial balance and balance sheet.
- 9.3 Identify the revenue expenditure and capital expenditure.
- 9.4 Select the items to be posted in the trading account, profit & loss account and the balance sheet.
- 9.5 State the adjustment to be made from the given information below or above the trial balance.
- 9.6 Prepare trading account, profit & loss account and balance sheet from the given trial balance & other information.

10 Understand the cost and financial accounting.

- 10.1 Define financial accounting.
- 10.2 State the objectives of financial accounting.
- 10.3 Define cost accounting.
- 10.4 Discuss the relationship between financial Accounting and cost accounting.
- 10.5 State the elements of direct cost and indirect cost.

10.6 Prepare cost sheet showing prime cost, factory cost, cost of production, total cost and selling price.

10.7 Discuss the capital budgeting

10.8 Discuss the discounted cash flow method

10.9 Explain the following terms:

- a. Fixed cost b. Variable cost c. Factory cost d. Overhead cost e. Process cost
f. Direct cost g. Operating cost h. Standard cost

11 Understand the depreciation

11.1 Define depreciation.

11.2 State the objects of depreciation.

11.3 Discuss the necessity for charging depreciation.

11.4 Describe the different methods of determining depreciation.

11.5 Explain the relative merits and demerits of different method of depreciation.

12 Understand the public works accounts.

12.1 State the important aspects of public works accounts.

12.2 Describe the main features of public works accounts.

12.3 Explain "Revenue and Grant".

12.4 Define Value Added Tax (VAT)

12.5 State the merits and demerits of VAT.

12.6 Define Bill and Voucher.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

CONSTRUCTION TECHNOLOGY (88)

**SYLLABUS
(COURSE STRUCTURE-2010)**

SIXTH SEMESTER

AIMS

- To be able to understand the methods and techniques used in construction of various kinds of bridges and culverts.
- To be able to understand the features of steel structure and basic concept of steel structure buildings.
- To be able to understand the features, construction procedure and maintenance of flyover and tunnel.
- To be able to understand the features, construction procedure and maintenance of foot overbridge and underpass.
- To be able to understand the methods and techniques used in construction of embankment, and jetty.
- To be able to understand the features of shell structure.
- To be able to understand the basic concept of Transmission Tower System.

SHORT DESCRIPTION

Construction process of various kinds of bridges and culverts; steel structure; steel building; flyover and tunnel; foot overbridge and underpass; port and harbor; jetty; shell structure; transmission tower.

DETAIL DESCRIPTION**Theory:****1 Understand the features of bridge and culverts.**

- 1.1 Define bridge and culverts.
- 1.2 Distinguish between bridge and culverts.
- 1.3 Mention the ideal site for construction of a bridge or culvert in roads and Highways.
- 1.4 Mention the classification of bridge and culverts.
- 1.5 Mention the factors which affect the choice and type of bridge or Culverts.
- 1.6 Define the terms:
 - (i) Flood discharge
 - (ii) Water way
 - (iii) Scouring depth
 - (iv) Free board
- 1.7 Identify different parts of a bridge.

2 Understand the construction procedure and maintenance of bridge and culverts.

- 2.1 Describe the construction of wing wall

and abutment of a bridge.

2.2 Explain the construction of deck slab.

2.3 Explain the term bridge management.

2.4 Explain the necessity of repair and maintenance of bridge and culverts.

2.5 Describe the procedure of repair and maintenance of bridge and Culverts.

3. Understand the features of steel structure.

3.1 Mention the terms steel structure.

3.2 Describe various types of structural members.

3.3 Mention the various sections for structural purposes.

3.4 Describe various types of steel structure.

3.5 Mention the advantages of steel structure.

4 Understand the features of steel bridge.

4.1 State the steel bridge.

4.2 Describe the points to be considered for classification of a steel bridge.

4.3 Describe the various types of loads on the bridge.

4.4 Mention the following terms:

(i) Transverse load.

(ii) Deformation of truss.

(iii) Eccentric load.

4.5 Describe the following terms:

(i) Plate girder bridges.

(ii) Truss bridges.

(iii) Suspension or arch bridges.

4.6 Mention the advantages and disadvantages of steel bridge.

4.7 Comparing steel structure bridge with R.C.C. Structure Bridge.

4.8 Mention the causes of failure of a steel bridge.

4.9 Explain the process of maintenance of steel bridge.

5 Understand the basic concept of steel structure buildings.

5.1 State the steel structure building.

5.2 Understand the basic consideration of construction for various types of building.

5.3 Mention the points to be considered for steel building.

5.4 Describe the necessity of steel structure in industrial building.

5.5 Describe the following terms in frame:

(i) Action of load.

(ii) Direction of load.

(iii) Rigid joint.

(iv) Rivet joint.

(v) Welded joint.

(vi) Bolted joint.

5.6 Explain the necessity of steel structure building

5.7 Explain the repair and maintenance of steel structure

building.

6 Understand the features, construction procedure and maintenance of flyover.

- 6.1 Define flyover.
- 6.2 Mention the causes of flyover construction.
- 6.3 Mention the suitable location and site selection for flyover.
- 6.4 Describe the necessity and effect of flyover in metropolitan area.
- 6.5 Distinguish between bridge and flyover.
- 6.6 List about various equipments used in construct a flyover.
- 6.7 Mention about construction materials of flyover.
- 6.8 Mention the various construction procedure and steps to construct a flyover.
- 6.9 Describe about earthquake resisting and others security system in flyover.
- 6.10 Explain the necessity and procedure of repair and maintenance of flyover.
- 6.11 Explain the cause of failures of flyover.
- 6.12 Describe about future plan for flyover and traffic system in Bangladesh.

7 Understand the features, construction procedure and maintenance of tunnel.

- 7.1 Define tunnel.
- 7.2 Mention the purpose and utility of tunnel.
- 7.3 Mention the suitable location and site selection for tunnel.
- 7.4 Distinguish between tunnel and bridge.
- 7.5 Explain the advantage and disadvantages of tunnel.
- 7.6 Describe the usages and necessity of tunnel in modern life.
- 7.7 Describe about various equipments used in construct a tunnel.
- 7.8 Mention about construction materials of tunnel.
- 7.9 Mention the various construction procedure and steps to construct a tunnel.
- 7.10 Describe about earthquake resisting and others security system in tunnel.
- 7.11 Explain the procedure of maintenance of tunnel.
- 7.12 Describe the necessity of tunnel in Bangladesh.

8 Understand the features, construction procedure and maintenance of foot

- 8.1 Define foot over bridge and underpass
- 8.2 Describe about various kinds of foot over bridge and underpass.
- 8.3 Mention the purpose and utility of foot over bridge and underpass
- 8.4 Mention the points to be considered in selecting the suitable location and site for a foot over

- 8.5 Describe the necessity and effect of foot over bridge and underpass in busy
- 8.6 Mention about construction materials of foot over bridge and underpass
- 8.7 Explain the cause of failures and remedies of foot over bridge and
- 8.8 Mention the differences between foot over bridge and underpass.
- 8.9 Explain the necessity and procedure of repair and maintenance of foot over

9 Understand the basic concept of harbor.

- 9.1 State the meaning of harbor.
- 9.2 Mention the purposes and utility of harbor.
- 9.3 Mention different types of harbor.
- 9.4 Mention the suitable location for harbor.
- 9.5 Describe the following terms:
 - (i) Natural harbor
 - (ii) Semi-natural harbor
 - (iii) Artificial harbor
 - (iv) Military harbor and
 - (v) Commercial harbor

10 Understand the basic concept of port.

- 10.1 State the meaning of port.
- 10.2 Mention the purposes and utility of port.
- 10.3 Mention the classification of port.
- 10.4 Mention the suitable location for port.
- 10.5 Mention the points to be considered in selecting the site for a port.
- 10.6 Describe briefly port of entry, ocean port, inland water way port, fr

11 Understand features of jetty.

- 11.1 Define jetty.
- 11.2 Explain the necessity of jetty in a port.
- 11.3 Mention different parts of a jetty.
- 11.4 Describe the construction procedure of a jetty.
- 11.5 Describe the necessity of sheet piling in construction of jetty.
- 11.6 Explain the process of repair and maintenance of jetty.

12 Understand the features and construction process of various water control structure.

- 12.1 Define water control structure.
- 12.2 Mention different types of water control structure.
- 12.3 Describe the following terms with construction procedure:
 - (i) Dam.
 - (ii) Dyke.
 - (iii) Sluice gate.
 - (iv) Water regulator.
 - (v) Pump House.

12.4 Describe the terms core wall and line of saturation with sketches.

12.5 State the meaning of following terms:

- (i) Barrage.
- (ii) Weir.
- (iii) Spillway.
- (iv) Cannel lining.

13 Understand the features of shell structure.

13.1 Define shell structure.

13.2 Explain the advantages of shell structure.

13.3 Describe the design procedure of shell structure.

13.4 Explain the construction procedure of shell structure.

13.5 Describe the procedure of repair and maintenance of shell structure.

14 Understand the basic concept of transmission tower system.

14.1 State the meaning of transmission tower.

14.2 Explain details about steel transmission tower.

14.3 List the various types of transmission tower.

14.4 Describe the various types of loads on transmission tower.

14.5 Describe various parts of a transmission tower.

14.6 Describe the construction procedure of steel transmission tower.

14.7 Mention about the materials and equipments using in a steel transmission tower.

14.8 Describe the following terms:

- (i) Telecommunication tower.
- (ii) Electrical tower.
- (iii) Watch tower.

14.9 Explain the process of repair and maintenance of transmission tower.

15. Understand the basic concept of tiles works.

15.1 Mention the purpose of tiles works.

15.2 List the materials used in tiles works.

15.3 Describe the process of preparation of surface before tiles works.

15.4 Describe the process of applying tiles on floor.

15.5 Mention the common tools used for tiles works.

15.6 Mention the classification of tiles.

15.7 Mention the common defects in tiles works.

Practical:

1 Perform the routine maintenance of bridge and culvert.

1.1 Select a bridge or culvert to be used for maintenance purpose.

1.2 Identify the components of the bridge to be repaired.

1.3 Prepare a repair and maintenance profile for the bridge.

1.4 Select and collect the materials necessary for the job.

1.5 Do the repair and maintenance work according to the profile?

2 Perform the identification of different types of bridge and culverts and their components.

2.1 Identify different types of bridge.

2.2 Identify different types of culverts.

2.3 Draw different types of bridge.

2.4 Draw different types of culverts.

2.5 Draw the detailed drawings of the components of bridge and culverts.

3 Perform the load capacity of various type of joint.

3.1 Observation of a welded joint in metal.

3.2 Observation of a Rivet joint in metal.

3.3 Test on welded joint in metal.

3.4 Test on Rivet joint in metal.

4 Show skill in identifying and construction of Transmission Tower.

4.1 Identify different types of transmission tower.

4.2 Make a model of tower by using bolted joint.

4.3 Prepare the base for a transmission tower.

5 Perform Tiles works.

5.1 Collects the required tools and materials for tiles works.

5.2 Makes the tiles floor according to the required size.

5.3 Check the accuracy of the tiles works.

6 Visit the following projects and collect data relating to the socio-economic aspects of the project for writing a report:

(i) Bridge project.

(ii) Over bridge project.

(iii) Underpass project.

(iv) Flyover project.

(v) Tunnel project.

REFERENCE BOOKS

1. Building Construction.

By B C Punmia.

2. Building Construction.

By G J Kulkarni.

3. Building Construction.

By S C Rangwala.

4. A Text Book of Construction.

By S P Aurora & S P Bindra.

5. Construction Technology volume 1 &2.

AIMS

- To be able to understand the estimating of framed structure multi-storied building.
- To be able to understand the estimating of bridge and culvert.
- To be able to estimate the quantity of MS rod for different RCC elements.
- To be able to understand the public works account and forms.
- To be able to understand the rate analysis process for different items of work in Building construction as per PWD standard.

SHORT DESCRIPTION

Complete estimate of framed structure building including sanitary works, Bridges and culverts, RCC retaining wall, bar schedule for one way, two way slab, column, footing and beams, preliminary estimate of building project work according to plinth, area rate, specification, Analysis of rates as per PWD standard.

DETAIL DESCRIPTION**Theory:****1. Understand the earth work in foundation and plinth.**

Mention the unit of earth work in excavation for foundation trenches.

Mention the unit of earth work in filling the plinth.

State the method of calculating earth work in excavation for foundation trenches.

State the method of calculating earth work filling of foundation trenches.

State the method of calculating earth work in filling plinth for rooms and verandah.

2. Understand the brick flat soling and mass concrete work.

Mention the unit of brick flat soling and mass concrete work.

Calculate the quantity of brick flat soling in foundation.

Calculate the quantity of brick flat soling in floors.

Calculate the quantity of mass concrete work in foundation.

Calculate the quantity of mass concrete work in floors.

3. Understand the reinforced cement concrete work in floors.

Mention the unit of reinforced cement concrete work in foundation.

State the method of calculating reinforced cement concrete work in column footing.

Calculate the quantity of reinforced cement concrete work in column up to plinth or

below grade beam.

Calculate the quantity of reinforced cement concrete work in grade beam.

4. Understand the reinforced cement concrete work in superstructure.

Mention the unit of reinforced cement concrete work in superstructure.

Calculate the quantity of reinforced cement concrete work & ms rod in column.
Calculate the quantity of reinforced cement concrete work & ms rod in tie beam / lintels.

Calculate the quantity of reinforced cement concrete work & ms rod in floor / roof beams.

Calculate the quantity of reinforced cement concrete work & ms rod in floor / roof slabs / Cantilever slab, porch slab etc.

Calculate the quantity of reinforced cement concrete work in sunshade, shelves, railing, drop wall, fins or louvers (horizontal and vertical) etc in sqm.

Calculate the quantity of reinforced cement concrete work & ms rod in stair case.

5. Understand the brick work in foundation and superstructure.

Mention the unit of brick in foundation and superstructure.

Mention the unit of brick (half brick thick wall) in partition walls.

Calculate the quantity of brick in plinth wall.

Calculate the quantity of brick work (one brick thick wall) in super structure.

Calculate the quantity of brick work (half brick thick wall) in partition walls.

6. Understand the cement plaster work.

Mention the unit of cement plaster works.

Calculate the quantity of cement plaster work on inner side of brick wall.

Calculate the quantity of cement plaster work on outer side of brick wall.

Calculate the quantity of cement work on reinforced cement concrete surfaces such as column, lintel, beam, ceiling, sunshade, shelve, railing, drop wall, fins or louvers and stair case etc.

7. Understand the wood work in doors and windows.

Mention the unit of wood works in door and windows frames.

Mention the unit of wood works in doors and window shutters.

Calculate the quantity of wood work in door frames.

Calculate the quantity of wood work in door shutters.

Calculate the quantity of wood work in window frames.

Calculate the quantity of wood work in window shutters.

8. Understand the grill works.

Mention the unit of grill work.

Calculate the quantity of grill works in windows and verandah.

Calculate the quantity of grill works in verandah.

9. Understand the patent stone flooring, mosaic work, tiles and skirting.

Mention the unit of patent stone flooring, mosaic work tiles and skirting.

Describe the method of calculating patent stone flooring.

Describe the method of calculating mosaic work on toilet floor.

Describe the method of calculating mosaic work on toilet wall.

Describe the method of calculating glazed tiles on toilet wall.

Describe the method of calculating skirting work.

10. Understand the lime terracing work over roof slab.

Mention the unit of lime terracing works.

Describe the method of calculating lime terracing work.

Describe the method of providing necessary slope to desired directions.
Describe the method of providing ghundi or hollow.
List the materials required for lime terracing work.

11. Understand the surface finishing works of building.

Mention the unit of surface works.
Describe the method of calculating white wash (inside only).
Describe the method of calculating color wash (outside only).
Describe the method of calculating distemper (inside only).
Describe the method of calculating plastic emulsion paint (mostly used inside only).
Calculate the quantity of snowcem wash or weather coat (mostly used outside only).

12. Understand the painting /varnishing of doors and windows.

- 12.1 Mention the unit of painting and varnishing works.
- 12.2 Calculate the quantity of synthetic enamel paint to doors.
- 12.3 Calculate the quantity of synthetic enamel paint to windows.
- 12.4 Calculate the quantity of synthetic enamel paint to grills.
- 12.5 Calculate the quantity of synthetic enamel paint to skirting.
- 12.6 Calculate the quantity of varnishing/French polish to doors.
- 12.7 Calculate the quantity of varnishing/French polish to windows.

13. Understand the estimation of RCC slab culvert.

- 13.1 State the purpose of culvert construction.
- 13.2 Calculate the quantity of earthwork in excavation for foundation trenches of culvert.
- 13.3 Calculate the quantity of brick flat soling in culvert.
- 13.4 Calculate the quantity of mass concrete work in culvert.
- 13.5 Calculate the quantity of brickwork in culvert.
- 13.6 Calculate the quantity of RCC work in culvert.
- 13.7 Calculate the quantity of cement plaster work in culvert.
- 13.8 Calculate the quantity of earth-filling work in culvert.
- 13.9 Distinguish between culverts and bridges.

14. Understand the estimation of RCC T-beam decking bridge.

- 14.1 State the purpose of bridge construction
- 14.2 Calculate the quantity of earth work in excavation for foundation trenches of bridge.
- 14.3 Calculate the quantity of brick flat soling in a bridge.
- 14.4 Calculate the quantity of mass concrete work in a bridge.
- 14.5 Calculate the quantity of brick work in a bridge.
- 14.6 Calculate the quantity of RCC work in a bridge.
- 14.7 Calculate the quantity of cement plaster work in a bridge.
- 14.8 Calculate the quantity of earth filling work in a bridge.
- 14.9 Mention the comparison the advantages and disadvantages of RCC Bridge and wooden Bridge.

15. Understand the estimate of RCC retaining wall.

- 15.1 Mention the purpose of retaining wall.
- 15.2 Calculate the quantity of earth work in excavation for foundation trenches of RCC retaining Wall.
- 15.3 Calculate the quantity of brick flat soling in RCC retaining wall.
- 15.4 Calculate the quantity of mass concrete work in RCC retaining wall.
- 15.5 Calculate the quantity of RCC work in RCC retaining wall.
- 15.6 Calculate the quantity of back filling work in RCC retaining wall.

16. Understand the estimate of septic tank.

- 16.1 State the purpose of septic tank.
- 16.2 State the way of calculating earth work in excavation for septic tank.
- 16.3 State the method of calculating brick work in septic tank.
- 16.4 State the method of calculating RCC work in septic tank.
- 16.5 State the method of calculating cement plaster work in septic tank.
- 16.6 State the method of calculating earth filling work in septic tank.

17. Understand the estimate of soak well.

- 17.1 State the purpose of soak well.
- 17.2 State the way of calculating earth work in excavation for soak well.
- 17.3 State the method of calculating brick work in soak well.
- 17.4 State the method of calculating RCC work in soak well.

18. Understand the estimate of stanchion (vertical iron column).

- 18.1 State the meaning of stanchion.
- 18.2 Identify the different components and accessories of stanchion.
- 18.3 State the way of calculating the quantities of steel (Iron) required in stanchion.
- 18.4 State the way of calculating the quantities of gusset plate, bolts and nuts used stanchion.
- 18.5 State the way of calculating the painting work of stanchion.

19. Understand the preliminary estimate for building project work according to plinth area rate.

- 19.1 Mention the meaning of preliminary estimate.
- 19.2 Mention the basis of calculating preliminary cost estimate of a building project work.
- 19.3 Prepare preliminary cost estimate for building project work according to Plinth area rate.

20. Understand the specification of materials and items of work.

- 20.1 Mention the meaning of specification of materials and items of work.
- 20.2 Mention the different types of specifications.
- 20.3 Describe the process of writing of specification of materials and items of work.

20.4 Mention the specification of particular form of works as per direction of the class teacher.

21. Understand the project of analysis of rates of various items of work as per PWD standard.

- 21.1 Mention the requirement of rate analysis.
- 21.2 Mention the importance of factor that affects the analysis of rates.
- 21.3 Describe the procedure of rate analysis to calculate the rate per unit of the item of works.
- 21.4 List the quantity of materials and number of different categories of labor

For the following items of work and analysis the unit rate including Contractors profit, overhead expenses, income tax (IT) and value added

Tax (VAT) as per PWD standard:

- a. Earth work in excavation for foundation trenches
- b. Earth filling and sand filling in foundation and plinth
- c. One layer brick flat soling in foundation and floor
- d. Cement concrete work (1:3:6) in foundation and floor
- e. Brick work in foundation up to plinth with cement mortar 1:6
- f. 75 mm thick damp proof course (DPC) in proportion 1:1.5:3
- g. Brick work of 250mm and above thick wall in superstructure with Cement mortar 1:6 and 1:4
- h. Brick work of 125 mm thick wall in super structure with cement Mortar 1:4
- i. RCC work in proportion 1:2:4 and 1:1.5:3 including shuttering cost (Footing, grade beam, column below and above plinth, lintel and tin Beam, drop wall, shelves, louver, parapet etc. and stair slab).
- j. Mild steel reinforcement fabrication work in different types of RCC Work for one quintal of work

- k. Patent stone flooring in proportion 1:1.5:3 with neat cement finish.
- l. 20 mm thick cement plaster (1:4) with neat cement finish.
- m. Average 12 mm thick cement plaster (1:6) to brick walls
- n. Average 6 mm thick cement plaster (1:4) to RCC surfaces
- o. Line terracing work with proportion of 2:2:7 over roof slab
- p. Teak wooden door frame and 38 mm thick paneled door shutter.
- q. Aluminum swing door and sliding window.
- r. Steel glazed window shutters with Z-section, T-section and F1 bars.
- s. White washing, color washing, distempering, snowcem washing, Plastic emulsion paint, synthetic enamel paint wherever necessary.

- t. Installation of European type commode and Indian type long pan (WC) with jow level flashing tank, bath tub, wash hand basin, sink, Squaring and standing urinals.

Practical:

1. Prepare the estimation of earthwork for excavation of foundation trenches Both by separate wall method and centre line method.

- 1.1 Select a drawing of a 4-storied residential building consisting of two or more bed rooms with attached toilets, living room, dining, kitchen, verandah etc..
- 1.2 Determine the length, breadth and depth of foundation trenches of long walls and short walls.
- 1.3 Determine the length, breadth and depth of foundation trenches of inner / partition wall.
- 1.4 Determine the length, breadth and depth of foundation trenches of verandah wall.
- 1.5 Calculate the quantity of earthwork for excavation of foundation trenches of long wall & short wall, inner/partition & verandah walls.
- 1.6 Determine the center length, breadth & depth of foundation trenches of main outer walls.
- 1.7 Determine the center length, breadth & depth of foundation trenches of main inner/partition walls.
- 1.8 Determine the center length, breadth & depth of foundation trenches of verandah walls.
- 1.9 Estimate the quantity of earthwork of foundation trenches in outer wall, inner/partition wall & verandah walls.

2 Prepare the estimation of earthwork for filling the sides of foundation trenches.

- 2.1 Determine the length, breadth & depth of filling the sides of trenches.
- 2.2 Calculate the quantity of earth filling in foundation trenches.

3 Prepare the estimation of sand filling in plinth..

- 3.1 Determine the length, breadth & depth/height of filling in floor of rooms & verandah.
- 3.2 Calculate the quantity of sand filling in plinth.

4 Prepare the estimation of brick flat soling in foundation and floors.

- 4.1 Determine the length & breadth for brick flat soling in foundation of main outer walls, inner/partition wall & verandah walls in both of separate wall & center line method.
- 4.2 Calculate the area of brick flat soling in foundation of main walls, inner/partition wall & verandah walls.
- 4.3 Determine the length & breadth of brick flat soling in floor.
- 4.4 Calculate the area of brick flat soling in floor.

5 Prepare the estimation of cement concrete work in foundation & floors.

- 5.1 Determine the length, breadth & thickness of cement concrete work in foundation of main walls, inner/partition walls & verandah walls in both of separate wall & center line method.
- 5.2 Calculate the quantity of cement concrete work in foundation of main walls, inner/partition wall & verandah walls.
- 5.3 Determine the length & breadth of cement concrete work in floor.
- 5.4 Calculate the quantity of cement concrete work in floor.

- 6 Understand Prepare the estimation of brickwork in foundation up to plinth by separate wall method & center line method.**
- 6.1 Determine the length, breath & depth of long walls for 1st, 2nd, 3rd footing and so on (if necessary) up to plinth.
 - 6.2 Determine the length, breadth & depth of short walls for 1st, 2nd, 3rd footing and so on (if necessary) up to plinth.
 - 6.3 Determine the length, breadth & depth of inner walls/partition wall for 1st, 2nd, 3rd footing and so on (if necessary) up to plinth.
 - 6.4 Determine the length, breadth & depth of verandah wall for 1st, 2nd, footing & so on (if necessary) up to plinth.
 - 6.5 Estimate the quantity of brickwork of long wall, short wall, inner/partition wall & verandah wall in 1st, 2nd, 3rd footing and so on (if necessary) up to plinth.
 - 6.6 Calculate the total quantity of brickwork in foundation up to plinth.
 - 6.7 Calculate the center length, breadth & depth of main outer walls.
 - 6.8 Determine the center length, breadth & depth of inner/partition walls & verandah walls.
 - 6.9 Determine the length, breadth & depth of steps.
 - 6.10 Calculate the quantity of brickwork in main outer walls, inner/partition walls, verandah walls for 1st, 2nd, 3rd footing and so on (if necessary) up to plinth.
 - 6.11 Calculate the brickwork in steps.
 - 6.12 Calculate the total quantity of brickwork up to plinth including steps.
- 7 Prepare the estimation of damp proof course (DPC) below superstructure.**
- 7.1 Calculate the length & breadth of main outer, inner/partition walls.
 - 7.2 Estimate the area of DPC over the plinth.
 - 7.3 Calculate the area for deduction of door or any other opening.
 - 7.4 Calculate the total area of DPC.
- 8 Prepare the estimation of brickwork in superstructure.**
- 8.1 Determine the length, breadth and height of the main wall (outer and inner) partition wall and parapet wall (if any).
 - 8.2 Calculate the quantity of brick walls in main superstructure walls (inner and outer).
 - 8.3 Calculate the quantity for deduction of door, window and other opening.
 - 8.4 Calculate the quantity for deduction of RCC lintel.
 - 8.5 Calculate the total quantity of brickwork in superstructure walls.
- 9 Estimate the quantity of RCC work in superstructure of a four storied building.**
- 9.1 Determine the length, breadth and depth the continuous RCC lintel.
 - 9.2 Calculate the quantity of RCC work in lintel.
 - 9.3 Determine the length, breadth and depth of the beam.
 - 9.4 Calculate the quantity of RCC work in beam.
 - 9.5 Calculate the quantity of RCC work in stairs.
 - 9.6 Determine the length, breadth and thickness of RCC floor slab/roof.
 - 9.7 Calculate the quantity of RCC work in floor slab/roof.
 - 9.8 Determine the length, breadth & thickness of the RCC sunshade, shelve, louver, drop walls and railing.

- 9.9 Calculate the quantity of RCC work in sunshade, shelves, louvers, drop walls and railing.
- 9.10 Calculate the total quantity of RCC work of a four storied building.

10 Prepare the estimation of plumbing, sanitary and drainage works.

- 10.1 Study the drawing of plumbing, sanitary and drainage works.
- 10.2 List the different fittings and fixtures for sanitary and water supply works.
- 10.3 Calculate the number of different fittings and fixtures for sanitary and water supply works.
- 10.4 Calculate the length of water supply pipes of different diameter required for plumbing and sanitary works.
- 10.5 Estimate the quantity of required items of drainage work of a building.

11 Estimate the quantity of RCC work and prepare the bar schedule for a column including footing.

- 11.1 Calculate the quantity of RCC works of square, rectangular, L-shaped, T-shaped, I-shaped, X-shaped and circular section column with block footing or sloped footing.
- 11.2 Prepare the bar schedule of MS rod for different types of column with footing.
- 11.3 Calculate the quantity of formworks required for different types of column.

12 Estimate the quantity of RCC work and prepare the bar schedule for Beams.

- 12.1 Calculate the quantity of RCC works of simply supported, semi-continuous, fully continuous, Cantilever and overhanging (tapered) beams.
- 12.2 Prepare the bar schedule of MS rod for different types of beams.
- 12.3 Calculate the quantity of formworks required for different types of Beams.

13. Estimate the quantity of RCC work and prepare the bar schedule for floor/ roof slab.

- 13.1 Calculate the quantity of RCC works of one-way, two-way, flat slab, cantilever and overhanging (tapered) slabs.
- 13.2 Prepare the bar schedule of MS rod for different types of slabs.
- 13.3 Calculate the quantity of formworks required for different types of slabs.

14. Estimate the quantity of RCC work and prepare the bar schedule for stairs.

- 14.1 Calculate the quantity of RCC works of a half turn stair.
- 14.2 Prepare the bar schedule of MS rod for stairs.
- 14.3 Calculate the quantity of formworks required for different types of stairs.

15. Estimate the wood work in door frames and shutters.

- 15.1 Identify the different sizes of doors.

- 15.2 Determine the length & sizes of door frames.
- 15.3 Calculate the quantity of wood work in door frames (cum).
- 15.4 Determine the breadth & height of door shutters.
- 15.5 Calculate the quantity of door shutters (sqm).

16. Estimate the wood work in window frames and shutters.

- 16.1 Identify the different sizes of windows.
- 16.2 Determine the length & sizes of window frames.
- 16.3 Calculate the quantity of wood work in window frames (cum).
- 16.4 Determine the breadth & height of window shutters.
- 16.5 Calculate the quantity of window shutters (sqm).

17. Estimate the patent stone flooring, mosaic work, tiles & skirting..

- 17.1 Determine the length & breadth of rooms and verandah for patent stone flooring.
- 17.2 Calculate the quantity of patent stone flooring in each floor.
- 17.3 Determine the length & breadth of rooms for mosaic works.
- 17.4 Calculate the quantity of mosaic works in each floor.
- 17.5 Determine the length & breadth of rooms for tiles work.
- 17.6 Determine the length & height of walls for tiles work.
- 17.7 Calculate the quantity of tiles work in each floor.
- 17.8 Determine the length & height of walls for skirting works.
- 17.9 Calculate the quantity of skirting works in each floor.

18. Estimate the quantity of white wash, color wash, snowcem wash, distemper, plastic paint

Where necessary.

- 18.1 Determine the length & breadth or height of walls and ceiling.
- 18.2 Calculate the quantity of area for white washing.
- 18.3 Determine the length & height of outside walls for color wash.
- 18.4 Calculate the quantity of area for color washing.
- 18.5 Determine the length & height of outside walls for snowcem wash.
- 18.6 Calculate the quantity of area for snowcem washing.
- 18.7 Determine the length & breadth or height of walls and ceiling.
- 18.8 Calculate the quantity of area for distemping.
- 18.9 Determine the length & breadth or height of walls and ceiling.
- 18.10 Calculate the quantity of area for plastic emulsion painting.

19. Estimate the painting and varnishing works to doors, windows, grills and skirting.

- 19.1 Identify the different sizes of doors, windows and grills.
- 19.2 Determine the length & height of each type of doors, windows and grills.
- 19.3 Calculate the quantity of area for painting and varnishing.
- 19.4 Determine the length & height of walls for skirting.
- 19.5 Calculate the quantity of area for skirting works.

20. Prepare an estimate of a septic tank with allied connections & fixtures.

- 20.1 Select a detail drawing of septic tank for 100 users.
- 20.2 Determine the necessary dimensions for detail estimate.

20.3 Estimate the different items of work of septic tank such as earth work in excavation & Filling, brick flat soling, CC & RCC in base & top slab, brick works, cement plaster, patent stone flooring including all fittings.

21. Prepare an estimate of a soak well.

21.1 Select a detail drawing of soak well for 100 users.
21.2 Determine the necessary dimensions for detail estimate.
21.3 Estimate the different items of work of soak well such as earth work in excavation, RCC in Curbs & top slab, solid & honey comb brick works, inside filling including all fittings.

22. Prepare an estimate of a RCC slab culvert.

22.1 Select a detail drawing of RCC slab culvert.
22.2 Determine the length, breadth & height or thickness of different members of the RCC slab culvert.
22.3 Estimate the different items of work of RCC slab culvert such as earth work in excavation & filling, brick flat soling, CC & RCC in base & top slab, brick works, cement plaster etc.

23. Prepare an estimate of a RCC T-beam decking bridge.

23.1 Select a detail drawing of a RCC T-beam decking bridge.
23.2 Determine the length, breadth & height or thickness of different members of the RCC T-Beam decking bridge.
23.3 Estimate the different items of work of RCC T-beam decking bridge such as earth work in Excavation & filling, brick flat soling, CC & RCC in base, beam & deck slab, brick works, Cement plaster etc.

24. Prepare an estimate of a two span box culvert.

24.1 Select a detail drawing of two span box culverts.
24.2 Determine the length, breadth & height or thickness of different members of the two spans box culvert.
24.3 Estimate the different items of work of two span box culvert such as earth work in Excavation & filling, brick flat soling, RCC in box etc.

25. Prepare an estimate of a RCC retaining wall.

25.1 Select a detail drawing of a RCC retaining wall.
25.2 Determine the length, breadth & height or thickness of stem and base of the retaining wall.
25.3 Estimate the quantity of RCC work in stem and base of retaining wall.
25.4 Determine the measurement of reinforcement of the retaining wall.

25.5 Calculate the quantity of reinforcement required for the retaining wall.

26. Prepare a preliminary estimate for a building project work according to plinth area rate.

26.1 Identify a building project work.

26.2 Study the building project to be done.

26.3 Classify the plinth area if necessary.

26.4 Determine the actual plinth area of the building project.

26.5 Calculate the preliminary costing for the building project according to plinth area rate as determined by a genuine agency.

27. Prepare the detail specification of important building materials.

27.1 Identify different important building materials for writing specification.

27.2 Write the detail specification of the important materials such as brick, sand, cement, coarse Aggregate, water, mild steel reinforcement, surki, lime, paint, distemper, timber, GI pipes etc.

28. Prepare the detail specification of important items of work of building.

28.1 Identify different items of work of building for writing specification.

28.2 Illustrate different items of work which should be clearly understandable to the supervisor, workmen & contractors.

28.3 Write the detail specification of important items of work of building such as earth work in Excavating, earth work in filling, brick flat soling, brick work, cement plaster, mass Concrete, reinforced cement concrete, test of concrete, form work, curing, lime terracing, white washing, color washing, snowcem washing, plastic painting, enamel painting, wood works in doors & windows, grill works, patent stone flooring, mosaic work, skirting etc.

29. Prepare a sample of tender documents for the construction of a two-storied framed structure

Building.

29.1 Make the followings:

- a. Cover page of the tender documents;
- b. contents belongs the tender documents ;
- c. tender notice;
- d. abstract of tender;
- e. instructions to tenderers;
- f. tender form
- g. specimen of deed of agreement ;
- h. conditions of contract;
- i. detail specifications of materials;
- j. detail specifications of items of civil work;
- k. detail specifications of items of sanitary & water supply work;

- l. detail specifications of items of electrical work;
- m. detail specifications of items of gas connection work ;
- n. schedule of items of works ;
- o. abstract of cost ;
- p. arrange all the papers and bind the document; and
- q. submit the document to assess by the class teacher.

REFERENCE BOOKS

1. A Text Book of Estimating and Costing
-by G S Birdie
2. Civil Estimating Quantity Surveying and Valuation
-by Amarjit Agarwal
3. Estimating and Costing
-by S C Rangwala
4. Tender documents of any building project prepared by Bangladesh Public Works Department (BPWD) or any other govt. organizations or any reputed civil Engineering consulting firms in Bangladesh.

AIMS

- To be able to understand the properties of reinforced cement concrete (RCC).
- To be able to select the suitable size of reinforced concrete beams & lintels with reinforcement.
- To be able to supervise the placing of reinforcement for beams & lintel.

SHORT DESCRIPTION

Reinforced cement concrete; Theory of bending; Investigation of beam; Shear stress and bond stress; Design of reinforced cement concrete rectangular beam, T-beam, double reinforced beam and lintel.

DETAIL DESCRIPTION**Theory:**

- 1 Understand the different type of cement concrete works.**
 - 1.1 Describe the plain concrete, reinforced concrete and prestressed concrete.
 - 1.2 Describe the different uses of the plain concrete, reinforced concrete and prestressed concrete.
 - 1.3 Mention the advantages, disadvantages & limitations of the plain concrete.
 - 1.4 Mention the advantages, disadvantages & limitations of the reinforced concrete.
 - 1.5 Mention the advantages, disadvantages & limitations of the prestressed concrete.
- 2 Understand the structural safety, design code and safety provision.**
 - 2.1 Explain the need for structural safety.
 - 2.2 Solve simple problems using the design codes.
 - 2.3 Explain the necessity for safety provision.
- 3 Understand about the loads in designing reinforced concrete works.**
 - 3.1 Define the meaning of load.
 - 3.2 Classify different kinds of loads.
 - 3.3 Define Richter scale, tectonic plate and epicenter.
 - 3.4 Explain the necessity of considering the seismic load and wind load in designing reinforced concrete works.
 - 3.5 Mention the significant of the thrust (like tidal, cyclones etc.) to be consider in designing reinforced concrete structure in coastal zone.
- 4 Understand stress, strain and elasticity of concrete.**
 - 4.1 State the meaning of stress, strain, ultimate stress and allowable stress of concrete.
 - 4.2 Define young modulus of elasticity of concrete.
 - 4.3 Calculate young modulus of elasticity of concrete.
 - 4.4 Interpret stress-strain curve of steel and concrete.
 - 4.5 Mention the purpose of compression test of concrete.
 - 4.6 State the different size & shape of moulds for compression test.

- 4.7 Describe test procedure of crushing cubes and cylinders for compression test.
- 4.8 Determine ultimate stress of concrete (f_c) and allowable stress of concrete (f_c).
- 4.9 Determine the allowable shear stress of concrete using ultimate stress of concrete.
- 5 Understand the properties & behavior of reinforcing steel used in RCC.**
 - 5.1 List the different types & grades of steel used in RCC and prestressed concrete.
 - 5.2 Mention the advantages of uses of mild steel in RCC.
 - 5.3 Describe the scope of using welded wire fabric in RCC.
 - 5.4 Mention the characteristics of plain bar, deformed bar and twisted bar and tendon.
 - 5.5 Mention the advantages of uses of deformed and twisted bar in RCC.
 - 5.6 State the minimum reinforcement used in RCC beam and slab.
- 6 Understand the flexure formula of homogeneous beam.**
 - 6.1 Define resisting moment.
 - 6.2 Explain the stress diagram of a loaded beam.
 - 6.3 Identify compression and tension zones of a homogenous beam.
 - 6.4 Express the derivation of the flexure formula for homogeneous beam.
 - 6.5 Solve the problems on homogeneous rectangular beam.
- 7 Understand the concept of transformed section of beam.**
 - 7.1 Define transformed section.
 - 7.2 Explain the theory of transformed section with sketches.
 - 7.3 Express the derivation of the equation for investigating the stresses developed in concrete and steel by transformed section method.
 - 7.4 Calculate the stresses developed in rectangular beam and T-beam in WSD method.
 - 7.5 Explain balanced reinforced beam, under reinforced beam and over reinforced beam.
 - 7.6 Mention the effect of under reinforcement and over reinforcement in RCC beams.
- 8 Understand the flexure formula for RCC beam in working stress design (WSD) method.**
 - 8.1 State the assumptions used in developing the flexure formula.
 - 8.2 Explain the stress diagram of a loaded RCC beam.
 - 8.3 Mention the notations used in flexure formula in WSD method.
 - 8.4 Express the derivation of the flexure formula for RCC beam in WSD method.
 - 8.5 Solve problems of flexure formula based on WSD method.
- 9 Understand the shear stress developed in RCC beams.**
 - 9.1 Explain the effects of shear force and stress in RCC beams.
 - 9.2 State the meaning of diagonal tension.
 - 9.3 Explain the causes of creating diagonal tension in RCC beams.
 - 9.4 Express the derivation of the formula to determine shear stress developed in RCC beams.
 - 9.5 Solve the problems on shear stress developed in WSD method.
 - 9.6 Solve the problems on shear stress developed in USD method.
 - 9.7 Mention the allowable shear stress for RCC beam (v) and shear stress for concrete (v_c).
- 10 Understand the functions of web reinforcement in RCC beams.**
 - 10.1 Define web reinforcement.
 - 10.2 Classify web reinforcement with sketches.
 - 10.3 Mention the functions of web reinforcement in RCC beams.

- 10.4 Determine the spacing of web reinforcement (vertical & inclined) in WSD method.
- 10.5 Determine the spacing of web reinforcement in USD method.
- 10.6 Determine the portion of the RCC beam requiring web reinforcement.
- 11 Understand the bond stress developed in RCC beams.**
 - 11.1 State the meaning of bond stress.
 - 11.2 Express the derivation of the formula to determine bond stress developed in RCC beams.
 - 11.3 State the allowable bond stress for plain bar and deformed bar in WSD and USD methods.
 - 11.4 Determine the anchorage length of reinforcement in RCC.
 - 11.5 Explain the necessity of standard hooks of reinforcement in RCC.
- 12 Understand the design of RCC rectangular beam in WSD method.**
 - 12.1 Outline the design steps of RCC rectangular beam in WSD method.
 - 12.2 State the minimum spacing of reinforcing bars in RCC beam.
 - 12.3 Design a simply supported RCC rectangular beam in WSD method.
 - 12.4 Design a semi-continuous RCC rectangular beam in WSD method.
 - 12.5 Design a continuous RCC rectangular beam in WSD method.
- 13 Understand flexure formula in ultimate strength design (USD) method.**
 - 13.1 Differentiate WSD and USD method.
 - 13.2 Explain the stress diagram of loaded beam with showing the actual & equivalent rectangular stress distribution of ultimate load.
 - 13.3 State the load and load factors used in USD method.
 - 13.4 Mention the notations used in flexure formula in USD method.
 - 13.5 Express the derivation of the flexure formula in USD method.
 - 13.6 Solve problems of flexure formula based on USD method.
- 14 Understand the design of RCC rectangular beam in USD method.**
 - 14.1 Outline the design steps of RCC rectangular beam in USD method.
 - 14.2 Design a simply supported RCC rectangular beam in USD method.
 - 14.3 Design a semi-continuous RCC rectangular beam in USD method.
 - 14.4 Design a continuous RCC rectangular beam in USD method.
- 15 Understand the design of RCC cantilever & overhanging rectangular beams in WSD method.**
 - 15.1 Determine the design load, shear force and bending moment of RCC cantilever & overhanging beams.
 - 15.2 Design a cantilever RCC rectangular beam.
 - 15.3 Design an overhanging RCC rectangular beam.
 - 15.4 Describe the technique of curtailment of reinforcement in cantilever RCC beams.
- 16 Understand the T-beam and its uses.**
 - 16.1 Define T-beam.
 - 16.2 Identify the different parts of a typical T-beam.
 - 16.3 Determine the width of flange of T-beam considering span length and slab thickness.
 - 16.4 State the ratio of width of web to the depth of web for T-beams.
 - 16.5 Distinguish between RCC rectangular beam and T-beam.
- 17 Understand the design of RCC T-beams.**
 - 17.1 Determine the depth and width of a simply supported T-beam in respect to shear force.
 - 17.2 Outline the design steps of RCC T-beam in WSD method.
 - 17.3 Design a simply supported RCC T-beam in WSD method.
 - 17.4 Design a semi-continuous RCC T-beam in WSD method.
 - 17.5 Design a continuous RCC T-beam in WSD method.
- 18 Understand the design of RCC beam with compression reinforcement.**
 - 18.1 State the meaning of double reinforced beam.

- 18.2 Differentiate between RCC single and double reinforced beam.
- 18.3 Outline the design steps of double reinforced beam.
- 18.4 Design a simply supported double reinforced beam.
- 18.5 Design a semi-continuous double reinforced beam.
- 18.6 Design a continuous double reinforced beam.
- 19 Understand the design of RCC lintel over doors & windows.**
 - 19.1 Determine the area of the wall to be considered in determining the design load for RCC lintels.
 - 19.2 Outline the design steps of RCC lintel.
 - 19.3 Design a RCC lintel over doors and windows.

Practical:

- 1. Conduct compression test of concrete for particular proportion with different water-cement ratio.**
 - 1.1 Mix concrete with different water-cement ratio.
 - 1.2 Fill in the mould (cylinder and cube).
 - 1.3 Keep cylinder and cube in the water for curing.
 - 1.4 Test the specimen in the compression test machine.
 - 1.5 Take the readings and tabulate in the form (test report).
 - 1.6 Calculate the ultimate and allowable compressive strength of concrete.
- 2. Conduct tensile strength test of mild steel for both plain bar and deformed bar of different diameters.**
- 3. Prepare a model of simply supported RCC rectangular beam as per drawing.**
- 4. Prepare a model of semi-continuous RCC rectangular beam as per drawing.**
- 5. Prepare a model of continuous RCC rectangular beam as per drawing.**
- 6. Prepare a model of double reinforced simply supported rectangular beam as per drawing.**
- 7. Prepare a model of RCC lintel as per drawing.**
- 8. Prepare a model of RCC lintel with sunshade as per drawing.**

REFERENCE BOOKS

1. Simplified Design of Reinforced Concrete
-by H Parker
2. Design of Concrete Structures
-by G Winter, L C Urquhart, C E O'Rourke, A H Nilson
3. Treasure of R C C Designs
-by Sushil Kumar
4. R C C Design
-by Abul Faraz Khan

AIMS

- To be able to understand the standard types of construction used in Bangladesh for road & pavement, bridge & culvert to assess the advantages and disadvantages of each type.
- To be able to understand the procedure, methods & techniques used in construction of road & pavement, drainage system, bridges & culverts, embankment & cuttings.
- To be able to understand the importance of traffic control system.
- To be able to understand the maintenance, servicing & repair procedure, methods & techniques used to keep the highway operational.
- To be able to acquaint with the different aspects of airport construction.

SHORT DESCRIPTION

Modes of transportation and history of road development; Highway planning; Road alignment and survey; Highway geometrics; Subgrade soil; Highway materials, Construction of road formation & classification of road; Low cost road; Water bound macadam road; Bituminous road; Cement concrete road; Hill road; Highway drainage; Traffic control; Road arboriculture; Highway machinery; Highway failures & maintenance; Highway bridges & culverts; Planning of airport; Geometric standard in airport, airport building & warehouses.

DETAIL DESCRIPTION**Theory:****1 Understand the modes of transportation and history of road development.**

- 1.1 Classify transportation.
- 1.2 Explain the importance of transportation.
- 1.3 Mention the benefits of good road system.
- 1.4 Describe in brief the history of road development.
- 1.5 Mention the characteristics of important early roads.
- 1.6 Describe the macadam and telford road construction.

2 Understand the concept of highway planning.

- 2.1 Explain the importance of highway planning.
- 2.2 Mention the objectives of highway planning.
- 2.3 Classify the road according to location & functions:
- 2.4 Mention the objectives of road planning & survey.

3 Understand the concept of alignment of road and survey.

- 3.1 Define alignment of road.
- 3.2 Mention the fundamental principles of alignment of road.
- 3.3 Mention the factors that controls the selection of alignment of road.

- 3.4 Describe the reconnaissance survey for a road construction.
- 3.5 Describe the preliminary survey, final location survey and soil survey for a road construction.
- 3.6 Mention the points to be considered in fixing location of a new urban road.

4 Understand the principles of highway geometric.

- 4.1 Classify the highway geometric into broad categories such as:
 - a) Cross-sectional elements (camber, super elevation)
 - b) Visibility
 - c) Horizontal / Vertical curves
 - d) Road intersections
- 4.2 State the meaning of friction.
- 4.3 Mention the factors that affect friction of coefficient.
- 4.4 Define the terms skid and slip.
- 4.5 Describe the factors that affect the highway geometrics.

5 Understand the concept of highway cross-section.

- 5.1 State the meaning of right of way.
- 5.2 Mention the factors on which the width of pavements depend.
- 5.3 State the terms in relation to road construction: formation width, side slope, berm, embankment, cutting, shoulder, carriage way width, footpath, cycle track, parking lanes, median strip, kerb.
- 5.4 State the meaning of camber.
- 5.5 Explain the necessity of camber.
- 5.6 Describe the procedure of providing camber in road.

6 Understand the concept of sight distance.

- 6.1 State the reaction time and reaction distance.
- 6.2 State the braking time and braking distance.
- 6.3 Classify the various types of sight distances.
- 6.4 Describe each type of sight distances.
- 6.5 Solve problems on stopping sight distance and passing sight distance.

7 Understand the concept of curve ,super elevation and gradient.

- 7.1 State the meaning of curve.
- 7.2 Classify the various type of curves used in highway.
- 7.3 Mention the reasons for extra widening of road on curve.
- 7.4 State the meaning of super elevation.
- 7.5 Describe the method of providing super elevation on site.
- 7.6 Solve the problems on super elevation.
- 7.7 State the meaning of gradient.
- 7.8 Classify the various types of gradient.
- 7.9 Mention the factors on which the gradient of a road depend.
- 7.10 Describe the methods of fixing grade line on site.

8 Understand the concept of highway intersections.

- 8.1 Define intersection of roads.
- 8.2 Mention the purposes of intersection of roads.

- 8.3 Classify the level intersection of roads.
- 8.4 Mention the advantages and disadvantages of each type of intersections and grade separations.
- 8.5 Define underpass and Overpass .

9 Understand the characteristics of sub-grade soil of highway.

- 9.1 Define the term sub-grade in highway.
- 9.2 Describe the characteristics of different sub-grade soil.
- 9.3 Mention the suitable sub-grade for various types of highway construction.
- 9.4 Describe the procedure of improving sub-grade soil for road construction.
- 9.5 Describe construction of road in water logged area.

10 Understand the characteristics of different materials suitable for highway construction.

- 10.1 Mention the advantages and limitations of aggregates for highway construction.
- 10.2 List the tests required for aggregates used for highway construction.
- 10.3 Describe different types of bituminous materials for road construction.
- 10.4 State the properties of bituminous materials.
- 10.5 List the standard tests on bituminous materials.

11 Understand the concept of road formation and classification of roads.

- 11.1 Describe the procedure of earth work in cutting , filling and compaction of soil..
- 11.2 Describe the turfing used in road embankment.
- 11.3 List the field tests needed to find out the good quality of compaction of soil for road construction.
- 11.4 Classify the road on the basis of materials, volume of traffic, type of traffic, number of lanes, direction of movement of traffic, area they traverse, cost of roads and rigidity of roads.
- 11.5 Mention the factors influencing the selection of types of base and surfacing of road.

12 Understand the construction of low cost road.

- 12.1 Classify the various types of low cost roads.
- 12.2 Describe the construction procedure of earthen road.
- 12.3 Describe the construction procedure of gravel road.
- 12.4 Describe the construction procedure of soil stabilized road.

13 Understand the construction of Water Bound Macadam (WBM) road.

- 13.1 Define water bound macadam road.
- 13.2 Describe the preparation of sub-grade for construction of WBM road.
- 13.3 Describe the spreading of coarse aggregate for construction of WBM road.
- 13.4 Describe the spreading of fillers in the construction of WBM road.
- 13.5 Describe the method of rolling the road in the construction of WBM road.
- 13.6 Describe the finishing of the surface and shoulders in the construction of WBM road.
- 13.7 Mention the advantages and disadvantages of WBM road.

14 Understand the construction of Bituminous road.

- 14.1 Define bituminous road.
- 14.2 Classify the different types of bituminous road.
- 14.3 List the materials used in the bituminous pavement.
- 14.4 Describe the specification of the materials used for bituminous pavement.
- 14.5 Describe the construction procedure of bituminous road.
- 14.6 Define the seal coat, tack coat and prime coat.
- 14.7 State the terms bituminous carpet, bituminous concrete, sheet asphalt and mastic asphalt.
- 14.8 Mention the advantages and disadvantages of bituminous road.

15 Understand the construction of Cement Concrete road.

- 15.1 Describe the construction procedure of cement concrete (CC), submergible Road in hoar areas and reinforced cement concrete (RCC) road.
- 15.2 List and explain the joints for CC and RCC road with their specification and sketches.
- 15.3 Describe joint fillers & sealers in CC road and RCC road.
- 15.4 Mention the functions of reinforcement & dowel bars in CC and RCC road.
- 15.5 Mention the advantages & disadvantages of CC and RCC road.
- 15.6 Distinguish between flexible and rigid pavement.

16 Understand the concept of hill road.

- 16.1 Mention the special points to be considered for alignment of hill road.
- 16.2 Define the terms: village path or track, bridle path, motor road, hill road, salient curves, re-entrant curve, hair pin bend, corner bend, trace cut.
- 16.3 State the meaning of retaining wall and breast wall.
- 16.4 Mention the causes of land slide.
- 16.5 Mention the preventive measures of land slide.

17 Understand the concept of highway drainage.

- 17.1 Mention the requirements of highway drainage.
- 17.2 Mention the factors which control the design of highway drainage system.
- 17.3 Mention the effects of improper drainage.
- 17.4 Describe the highway drainage system.
- 17.5 Classify the highway drainage.
- 17.6 Define cross-drainage work.
- 17.7 Classify cross-drainage works.

18 Understand the concept of traffic signs.

- 18.1 Classify the different types of traffic signs.
- 18.2 Explain the importance of traffic signs.
- 18.3 Mention the utility of traffic studies.
- 18.4 Mention the utility of traffic regulations.
- 18.5 Mention the utility of traffic signs.

19 Understand the concept of road arboriculture.

- 19.1 State the meaning of arboriculture.
- 19.2 Explain the purpose of plantation on road sides.
- 19.3 Describe the process of tree planting, pattern of tree planting and protection of trees on road sides.

19.4 Mention the advantages and disadvantages of trees on road sides.

20 Understand the machineries used for construction of roads & highways.

20.1 List the machineries used for cleaning the site, earth cutting, earth removing, consolidating and grading in highway construction.

20.2 List the machineries used for crushing road metals.

20.3 List the machineries used for construction of bituminous road.

20.4 List the machineries used for construction of CC & RCC road.

21 Understand the causes of failures of roads & highways.

21.1 Describe the sub-grade, base and wearing course failures.

21.2 Mention the typical failures of flexible pavement.

21.3 Mention the causes of failures of CC & RCC road.

21.4 Mention the typical failures of CC & RCC road.

22 Understand the maintenance of highway.

22.1 Explain the significance of routine maintenance of highways.

22.2 Classify the maintenance work of road.

22.3 Describe the maintenance of

(a) Earthen road.

(b) Water bound macadam road.

(c) Bituminous road.

(d) CC & RCC road.

22.4 Mention the causes for corrugations and wavy surfaces.

22.5 Mention the remedies for corrugations and wavy surfaces.

23 Understand the highway bridges & culverts.

23.1 Distinguish between bridge and culvert.

23.2 Mention the ideal site for construction a bridge or culvert in roads & highways.

23.3 Classify the different types of bridges and culverts.

23.4 Mention the factors which effects the choice & type of bridge or culvert.

23.5 Define the terms: flood discharge, waterway, scouring depth, free board in the construction of bridges & culverts.

23.6 Explain the necessity of repair and maintenance of bridges & culverts.

24 Understand the concept of planning of airport.

24.1 Mention the information required for planning of an airport.

24.2 Mention the points to be considered in selecting the site for an airport.

24.3 Describe the terms: landing strip, approach zone, running lengths & hanger.

24.4 Classify different types of airport.

25 Understand the standard of geometrics used in airport.

25.1 Explain the terms: runway, taxiway, aprons, runway orientation, pattern & grade.

25.2 Distinguish between runway and taxiway.

25.3 State the meaning of heliport.

25.4 Mention the functions of terminal building.

25.5 Distinguish between heliport and airport.

26 Understand the concept of airport building & warehouse.

- 26.1 Mention the functions of airport building.
- 26.2 Mention the facilities to be provided in airport building.
- 26.3 State the meaning of warehouse.
- 26.4 State the importance of warehouse.

Practical:

- 1. Setting an alignment of a new road.
- 2. Prepare the model of a typical clover leaf pattern of grade separation.
- 3. Perform crushing strength test of coarse aggregate used in road construction.
- 4. Perform abrasion test of coarse aggregate used in road construction.
- 5. Perform water absorption, specific gravity and density test of coarse aggregate used in road construction.
- 6. Perform the California Bearing Ratio (CBR) test.
- 7. Perform the aggregate impact value test.
- 8. Perform the test of grading of coarse aggregate.
- 9. Perform the following test for bitumen.
 - a. Loss of ignition
 - b. Softening point
 - c. Fire point.
 - d. Flash point
 - e. Marshal test
- 10. Prepare the models of different types of traffic signs.
- 11 . Average Daily traffic (ADT) survey in a busy road intersection.
- 12. Visit of a Fly Over/Overpass/Underpass/intersection/grade separation.
- 13. Visit of an International Airport.

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-by S B Sehgal & K L Bhanot
- 3. Highway Engineering -by S C Rangwala
- 4. Highway and Airport Engineering -by V B Priyani

AIMS

- To enable to select suitable methods for collection and distribution of water from given source to given community.
- To enable to identify impurities of water of given sources and selected suitable method/methods of purification up to potable standard.
- To assist in comparing various types of water pipes and pipe fittings.
- To develop understanding of the procedure of construction, repair, replacement and maintenance of water supply systems.
- To provide understanding of the socio-economic aspect of water supply and sanitation(WSS).

SHORT DESCRIPTION

Introduction; Water requirements; Sources of water; Water pipes; Collection and transmission of water; Quality of water; Treatment of water (clarification); Treatment of water (filtration); Treatment of water (disinfection); Treatment of water (softening); Miscellaneous water treatment; Water distribution; Water reservoir; Distribution system; Rural water supply system; Plumbing system; Socio-economic aspects of water supply and sanitation(WSS).

DETAIL DESCRIPTION**Theory:**

- 1 Understand the concept of environmental engineering.**
 - 1.1 Define environmental engineering.
 - 1.2 State the branches of environmental engineering.
 - 1.3 Explain the scope of environmental engineering.
 - 1.4 Describe the importance of environmental engineering for civil engineers.
 - 1.5 State the role of civil engineers to maintain a healthy environment.
- 2 Understand the various aspects of consumption of water.**
 - 2.1 Describe population prediction and various methods of population forecast.
 - 2.2 Describe the various needs for clean water and list the quantities required for those purposes.
 - 2.3 Explain the influence of the factors which affect per capita consumption of water:
 - a. Size of city
 - b. Characteristics of population
 - c. Industries and commercial organization
 - d. Climatic condition
 - e. Metering of water
 - 2.4 Explain the demand of water for fire fighting and fire stand post.
- 3 Understand the different sources of water.**
 - 3.1 Identify different sources of water.
 - 3.2 Explain the hydrological cycle.
 - 3.3 State the advantages and disadvantages of ground water.
 - 3.4 Mention the advantages and disadvantages of surface water.
 - 3.5 Distinguish between the ground water supply and surface water supply in respect to quality of water.
 - 3.6 Explain rainwater harvesting

- 4 Understand the different type of pipes & pipe joints used in water supply and the reasons for corrosion in metal pipes.**
- 4.1 Classify the different type of pipes according to size, materials, quality, and allowable stresses used in Bangladesh.
 - 4.2 Explain the causes of corrosion of metal pipes.
 - 4.3 Describe the methods of prevention and protection against corrosion.
 - 4.4 Explain the causes of deterioration in non-metal pipes.
 - 4.5 Describe with sketches the different joints used in pipes.
 - 4.6 Describe with sketches the fittings of pipes and valves used.
- 5 Understand the collection and transmission system of water.**
- 5.1 Identify the different types of intake used in collecting surface water.
 - 5.2 Describe the different intake systems with sketches.
 - 5.3 Classify the different type of pumps used in water supply.
 - 5.4 Explain the uses and limitations of different type of pumps.
 - 5.5 Distinguish between turbine pump and submersible pump used in deep tube well.
- 6 Understand the various types of impurities in water.**
- 6.1 State the different type of impurities present in water.
 - 6.2 Explain the causes of turbidity, color, taste and odor in water.
 - 6.3 Mention the effects and maximum allowable limits(WHO & BSTI) of impurities (pH, colour, Turbidity, TDS, SS, Hardness, chloride, Nitrate, Iron, Sodium, Arsenic, Cadmium, lead, total coliform and faecal coliform) in water.
 - 6.4 Explain the causes and effects of alkanity, acidity and hardness in water.
 - 6.5 Describe the effects of gaseous impurities(carbon di-oxide, hydrogen sulphide, dissolved oxygen) in water.
 - 6.6 Mention the causes and effects of nitrate (methemoglobinemia) and lead poisoning (plumbism) in water.
- 7 Understand the safe water.**
- 7.1 Define safe water.
 - 7.2 Mention the common water borne diseases.
 - 7.3 Explain the relationship between safe water and health.
 - 7.4 List the different types of micro-organisms found in water.
 - 7.5 State the relationship between pathogenic bacteria and e-coli bacteria (indicator organism).
 - 7.6 Describe the contamination of water due to cross connection and plumbing defects, storage and back syphonage.
- 8 Understand the treatment of water by clarification.**
- 8.1 Explain a typical flow diagram of treatment plant units.
 - 8.2 Outline the need of screening of water.
 - 8.3 Mention the principle of plain sedimentation.
 - 8.4 Mention the principle of sedimentation with coagulation.
 - 8.5 State different types of coagulants with their purpose and action.
 - 8.6 Describe the process of flocculation.
 - 8.7 Describe a typical sketch of sedimentation tank.
- 9 Understand the treatment of water by filtration.**
- 9.1 Explain the need of filtration of water.
 - 9.2 State the theory of filtration of water for bacteriological removal.
 - 9.3 Explain the characteristics between the slow sand filter and rapid sand filter.
 - 9.4 Describe the operation difficulties of slow sand and rapid sand filters.

- 9.5 State the meaning of negative head and mud balls.
- 10 Understand the treatment of water by disinfection.**
- 10.1 Describe disinfection of water by chlorination.
- 10.2 Explain the advantages and limitations of disinfection of water by chlorination.
- 10.3 Compare the pre-chlorination, post chlorination, double chlorination and super chlorination.
- 10.4 Explain the advantages of break point chlorination.
- 10.5 Describe the following methods of disinfection of water:
- Heating and boiling
 - pH control
 - Using oxidizing agent
 - Ultra violet Ray
 - Ozone
- 11 Understand the treatment of water by softening.**
- 11.1 Distinguish between hard and soft water.
- 11.2 Explain the need of softening water.
- 11.3 list different processes of water softening
- 11.4 Describe the method of Ion-exchange process water softening
- 12 Understand the different processes of removing color, odor, taste, arsenic, iron, manganese and salinity.**
- 12.1 Explain the purpose of aeration.
- 12.2 Describe the different methods of aeration.
- 12.3 Describe the techniques of controlling algae and other aquatic growth.
- 12.4 Describe the process of removal of color, odor and taste by activated carbon.
- 12.5 Explain the different methods of removing arsenic, iron and manganese with flow diagram.
- 12.6 List the different methods of desalination of water.
- 13 Understand the different water distribution methods.**
- 13.1 State the different features of the distribution systems.
- 13.2 Describe with the help of sketches the different methods of supply of water.
- 13.3 Outline the advantages and disadvantages of different methods of supply of water.
- 13.4 Describe with sketches the different layout methods of distribution pipes.
- 13.5 Explain the relative advantages and disadvantages of different layout methods of distribution pipes.
- 13.6 State the different types of-
- Meter
 - Valves
 - Fire hydrant
 - Pipe & Fittings.
- 14 Understand different types of reservoir.**
- 14.1 Mention the different types of reservoir according to position and shape.
- 14.2 Explain the needs of roof tank and typical water reservoir in a building.
- 14.3 Describe the typical section of roof tank and water reservoir in a building.
- 15. Understand the construction and maintenance of distribution system.**
- 15.1 Describe the procedure of excavation and back filling for laying pipe lines.

- 15.2 Describe the procedure for-
- handling and laying pipes and their maintenance
 - placing and maintenance of hydrants and valves
 - cleaning of water mains and use of washout system.
- 16 Understand the water supply systems with specific reference to rural Bangladesh.**
- 16.1 Give introduction to different types of hand pumps: No. 6 hand pump, deep- set(tara) pump.
- 16.2 Describe the procedure of drilling, aquifer selection, back filling and installation techniques including developing of new tube well.
- 16.3 Explain the design procedure of tube well strainer.
- 16.4 Describe operation & maintenance of No. 6 hand pumps and deep-set(tara) hand pumps.
- 16.5 Explain the drilling problems in rocky areas.
- 16.6 Give introduction to alternative technologies in problem areas of Bangladesh: Shallow Shrouded Tube well(SST), Very Shallow Shrouded Tube well(VSST), Pond Sand Filter(PSF), Infiltration Galaries(IG), Iron Removal Unit (IRU) and Deep-set technologies.
- 17 Understand the importance of plumbing system.**
- 17.1 Define plumbing system.
- 17.2 List the requirements of plumbing installation.
- 17.3 Identify with sketches the various plumbing fittings and fixtures.
- 17.4 Describe the uses of various plumbing fittings and fixtures.
- 17.5 Differentiate between plumbing fittings and fixtures.
- 17.6 List the tools required for plumbing works.
- 17.7 Mention the uses and maintenance of various plumbing tools.
- 18 Understand the effect of socio-economic factors on water supply and sanitation.**
- 18.1 Describe the socio-economy of rural and urban area in Bangladesh.
- 18.2 Give definitions of demographic characteristics, power structure, cultural issues (traits), rural leadership and local government structure.
- 18.3 Describe the influence of socio-economic aspects on community water supply and sanitation.

Practical:

- 1 Identification of pipes and fittings.**
- Identify physically different type of pipes, fittings and joints.
 - Draw the sketches of typical plumbing fittings.
 - Cut pipes and cut a thread on the pipe.
 - Inspect installations to identify good and poor quality materials and workmanship
- 2 Demonstration of water purification plant and deep tube well.**
- Draw flow diagram of water purification processes after visiting a plant.
 - Draw section through a deep tube well.
 - Identify the major precautions needed during installation and use of deep tube well.
- 3 Maintenance works.**
- Identify, take out and replace unserviceable fixtures/ fittings or any other component parts.
 - Identify the common troubles of submersible pump and their solutions. after visiting pump house.

3.3 Identify the common troubles in water supply pipe lines and their solution by visiting concern authorities (WASA, City Corporation and Pourashava).

4 Conduct physical and chemical tests of water.

4.1 Conduct physical tests of water (pH value & turbidity) using field pH and turbidity meter.

4.2 Conduct chemical tests of water (iron, manganese and chloride) using field kits.

4.3 Conduct the arsenic test of water using field kits.

4.4 Conduct residual chlorine test using field kits.

4.5 Conduct hardness test using field kits.

5 Physically identify different parts of

a)No. 6 hand pump,

b)deep-set (tara) hand pumps.

c) Submersible pump

6. Inspect installation of

a)No. 6 hand pump,

b)deep-set (tara) hand pumps.

c) Submersible pump

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4. Plumbing (1991): Technical Teachers Training College Publication.
5. Aziz, M.A (1975) : Water supply and sanitation.

5840	ENVIRONMENTAL MANAGEMENT	T	P	C
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AIMS

- To be able to understand the basic concepts of environment and environmental pollution.
- To be able to understand the concepts of ecology, ecosystems, global environmental issues, air pollution, water pollution, soil pollution, radioactive pollution, sound pollution, etc.
- To be able to understand the methods of controlling air pollution, water pollution and sound pollution.
- To be able to understand the management of waste, soil and pesticide pollution and
- To be able to understand the major environmental issues and problems in Bangladesh.

SHORT DESCRIPTION

Basic concepts of environment; Ecology & eco-systems; global environmental issues Air and atmospheric layers; Air pollution sources & effects; climate change, green house effect and depletion of ozone layer; Control of air pollution; Water pollution sources & effects; Monitoring of water pollution; Waste water treatment; Sound pollution and its control; Soil pollution and its management; Radioactive pollution and its control; Solid waste management; Major environmental issues and disaster management- Arsenic pollution; Pesticides pollution and its management, Environmental legislations and guidelines frame work and policy in Bangladesh.

DETAIL DESCRIPTION

- 1. Understand the basic concepts of environment.**
 - 1.1 Define: environment, Marine environment, Freshwater environment, Nutrients, Mangrove forest, Photo-chemical oxidant, Pollutant, Receptor, Sink, Pathways of pollutant, Speciation.
 - 1.2 Mention the main components of environment.
 - 1.3 Mention the functions of environment.
 - 1.4 Describe natural environment, man-made environment and social environment.

- 2. Understand ecology and eco-systems.**
 - 2.1 Define ecology and eco-system.
 - 2.2 Mention the range of tolerance in eco-system.
 - 2.3 Explain the biotic and abiotic components of eco-system.
 - 2.4 Explain briefly how does eco-system work.
 - 2.5 Explain the stability of eco-system.
 - 2.6 Explain the following ecological terms:
Food chain, Food web, Biodiversity, Biomass, Ecological pyramid, Pyramid of biomass, Pyramid of energy, Bio-concentration, Bio-magnification, Restoration ecology.
 - 2.7 Narrate the following bio-geochemical cycles of eco-system.
 - a) Carbon cycle
 - b) Nitrogen cycle
 - c) Phosphorus cycle

- d) Sulphur cycle.
- e) Hydrologic cycle

2.8 Describe the following global environmental issues: Global environment, Earth and other environmental summits, climate change and ozone layer depletion.

3 Understand the air and the atmospheric regions.

- 3.1 Mention different layers of atmosphere.
- 3.2 Mention the average composition of the atmosphere at sea level.
- 3.3 Describe the chemical species and particulates present in the atmosphere.
- 3.4 Describe the importance ozone layer.

4 Understand the air pollution and its sources & effects.

- 4.1 Define air pollution.
- 4.2 Mention the composition of clean dry atmospheric air.
- 4.3 List the air pollutants.
- 4.4 Identify the sources of air pollutions.
- 4.5 List the green house gases.
- 4.6 Mention the effects of air pollution on human health, animals, plants and non-living things.
- 4.7 Explain the formation of photo-chemical smog and its effect.
- 4.8 List the disasters of major air pollution in the world mentioning location, causes and effects.
- 4.9 Explain the causes of acid rain and its effect on eco-system.

5 Understand the control of air pollution at the sources.

- 5.1 Mention the methods of air pollution control.
- 5.2 Describe the following devices: gravitational settling chamber, cyclone separator, wet scrubber, centrifugal scrubber, fabric filter, catalytic converter.

6 Understand the sources of water pollution and its effects.

- 6.1 Define water pollution.
- 6.2 Mention the specification of ideal water as per recommendation of the World Health Organization (WHO).
- 6.3 List the different types of water pollutants.
- 6.4 Describe the sources of water pollution.
- 6.5 Describe the effects of water pollution on human health, animal, plants and environment.

7 Understand the monitoring of water pollution.

- 7.1 Define the following terms:
 - (i) Dissolved oxygen (DO).
 - (ii) Biochemical oxygen demand (BOD).
 - (iii) Chemical oxygen demand (COD).
 - (iv) Total organic carbon (TOC).
 - (v) Threshold limit value (TLV).
- 7.2 Mention the method of determination of pH value of water.
- 7.3 Mention the method of determination of dissolved oxygen (DO) in a sample of water.
- 7.4 Mention the method of determination of biochemical oxygen demand (BOD) in a sample of water.

7.5 Mention the method of determination of chemical oxygen demand (COD) in a sample of water.

8 Understand the waste water treatment.

8.1 Define the primary treatment, secondary treatment and tertiary treatment of waste water.

8.2 Define the following terms; ETP, Oxidation pond, waste stabilization pond, trickling filter, Activated slug.

8.3 Mention the methods of primary and secondary treatment of industrial waste water.

9 Understand the sound pollution and its control.

9.1 Define sound, sound wave and sound pollution.

9.2 Mention the scale of measuring sound intensity.

9.3 Mention the sources of sound pollution.

9.4 Describe the effect of sound pollution on human health.

9.5 Describe the methods of control of sound pollution.

10 Understand the soil pollution and its management.

10.1 Define soil pollution.

10.2 List the classification of soil pollution.

10.3 Mention the sources of soil pollution.

10.4 Describe the effect of soil pollution on human health.

11 Understand the radioactive pollution and its control.

11.1 Define radioactive pollution.

11.2 Mention the sources of radioactive pollution.

11.3 List the causes of radioactive pollution.

11.4 Explain the effect of radioactive pollution on human health.

11.5 Describe the method of control of radioactive pollution.

12 Understand the solid waste management.

12.1 Define solid waste.

12.2 List the sources of solid waste.

12.3 Mention the classification of solid waste.

12.4 Mention the methods of collection of solid waste.

12.5 Mention the waste management strategies in Bangladesh.

12.6 Describe the recycling of solid wastes.

12.7 Describe the potential method of disposal of solid waste.

13 Understand the major environmental issues in Bangladesh.

13.1 List the major environmental issues in Bangladesh.

13.2 Describe the following disaster management of Bangladesh flood, cyclone, tidal surge, Cyclone(SIDR, AILA, Nargis, Tsunami), landslide, earthquakes and salinity.

14 Understand the arsenic pollution in Bangladesh.

14.1 Mention the arsenic pollution of water in Bangladesh.

14.2 Explain the effects of arsenic pollution on human health.

14.3 Describe the causes of arsenic in ground water.

15 Understand the pesticide pollution in Bangladesh and its management.

15.1 Define pesticide.

15.2 Make a list of pesticides.

15.3 Mention the causes of pesticide pollution in Bangladesh.

15.4 Describe the effect of pesticide pollution in the environment.

16 Understand the national environmental legislations and guidelines environmental frame work and policy in Bangladesh.

- 16.1 Define, EA, EIA, IEA, NEMAP, DOE, BELA, GPS, GIS
- 16.2 Mention environmental act and legislations prescribed for air and water quality.
- 16.3 Describe environmental act prescribed for industries in Bangladesh.
- 16.4 Describe the guide lines of environment prescribed for industries in Bangladesh.
- 16.5 Describe the environmental frame work in Bangladesh.

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AIMS

- To be able to develop the working condition in the field of industrial or other organization.
- To be able to understand develop the labor management relation in the industrial sector.
- To be able to develop the management techniques in the process of decision making.
- To be able to manage the problems created by trade union.
- To be able to understand the network , PERT, CPM & MBO
- To be able to perform the marketing.
- To be able to maintain inventory.

SHORT DESCRIPTION

Basic concepts of management; Principles of management; Scientific management; Organization; Span of supervision; Motivation; Personnel management and human relation; Staffing and manpower planning ; Training of staff; Industrial dispute; Concept of leadership; Concepts and techniques of decision making; Concept of trade union; Inventory control; Economic lot size ; Break even analysis; Labour and industrial law; PERT , CMP ; Network ; Marketing; Production management;

1 Understand the basic concepts & principles of management.

- 1.1 Define management and industrial management.
- 1.2 State the objectives of modern management.
- 1.3 Describe the scope and functions of management.
- 1.4 State the principles of management.
- 1.6 State the activity level of industrial management from top personnel to workmen.
- 1.7 Describe the relation among administration, organization & management.
- 1.8 Define Production Management and functions of Production Management.
- 1.9 Explain the social responsibilities of management.

2 Understand the concept of scientific management.

- 2.1 Define scientific management.
- 2.2 Discuss the basic principles of scientific management.
- 2.3 Explain the different aspects of scientific management.
- 2.4 Discuss the advantages and disadvantages of scientific management.
- 2.5 Describe the difference between scientific management and traditional management.
- 2.6 Describe the following four periods of management thought:
 - (i) pre-scientific management.
 - (ii) scientific management.
 - (iii) human relations
 - (iv) refinement extension and synthesis of management theories and practices.

3 Understand the concepts of organization and organization structure.

- 3.1 Define management organization.

- 3.2 State the elements of management organization.
- 3.3 Discuss the types of organization structure
- 3.4 Describe different forms of organization structure.
- 3.5 Distinguish between line organization and line & staff organization.
- 3.6 Distinguish between line organization and functional organization.
- 3.7 Describe the feature advantages and disadvantages of different organization structure.
- 3.8 Define organizational chart.
- 3.9 Describe the different types of organizational chart.

4 Understand the basic concept of span of supervision.

- 4.1 Define span of supervision and optimum span of supervision.
- 4.2 Discuss the considering factors of optimum span of supervision.
- 4.3 Discuss advantages and disadvantages of optimum span of supervision.
- 4.4 Define delegation of authority.
- 4.5 Explain the principles of delegation of authority.
- 4.6 Explain the terms: authority, responsibility and duties.

5 Understand the concept of motivation.

- 5.1 Define motivation.
- 5.2 Discuss the importance of motivation.
- 5.3 Describe financial and non-financial factors of motivation.
- 5.4 State the motivation process or cycle.
- 5.5 Discuss the motivation theory of Maslows and Harzbergs.
- 5.6 Differentiate between theory-X and theory-Y.
- 5.7 Discuss the relation between motivation and morale.

6 Understand the concept of leadership.

- 6.1 Define leadership.
- 6.2 Discuss the importance and necessity of leadership.
- 6.3 Discuss the functions of leadership.
- 6.4 Identify the types of leadership.
- 6.5 Describe the qualities of a leader.
- 6.6 Distinguish between autocratic leader and democratic leader.

7 Understand the basic concepts and techniques of decision making.

- 7.1 Define decision making.
- 7.2 Discuss the importance and necessity of decision making.
- 7.3 Discuss different types of decision making .
- 7.4 Describe the steps in decision making.

8 Understand the concept of personnel management and human relation.

- 8.1 Define personnel management.
- 8.2 Discuss the importance of personnel management.
- 8.3 Discuss the functions of personnel management.
- 8.4 Define staffing.
- 8.6 Define recruitment and selection of employees.
- 8.7 Describe various sources of recruitment of employees.
- 8.8 Describe the various methods of selection of employees.
- 8.9 Discuss the advantages and disadvantages of internal sources of recruitment.
- 8.10 Discuss the disadvantages of external sources of recruitment.
- 8.11 Define training and orientation of employee.
- 8.12 Discuss the importance and necessity of training.
- 8.13 Discuss the various methods of training of workmen, technicians and

executive personnel.

9. Understand the concept of inventory control

9.1 Define inventory.& inventory control.

9.2 Describe the function of inventory control.

9.3 Discuss the necessity and importance of inventory control.

9.4 Mention the advantages and disadvantages of inventory control.

9.5 Explain the following terms :

- Bin card or Bin tag.
- Purchase requisition.
- Store requisition.
- Material transfer note.
- First in first out (FIFO).
- Last in first out(LIFO).
- PERT
- CPM
- NETWORK
- MBO

10 Understand the concept of economic lot size & break even analysis

10.1 Define economic lot size.

10.2 Discuss the effects of over supply and under supply.

10.3 Describe the method of determination of economic lot size.

10.4 Explain the terms :

- Safety stock
- Determination of safety stock
- Lead time

10.5 Define break even point and break even chart.

10.6 Explain the terms :

- Break even analysis.
- Fixed cost.
- Variable cost.

10.7 Discuss the importance of break even analysis.

10.8 Describe the method of preparing break even chart.

10.9 Describe different methods of break even analysis.

10.10 Draw break even chart in different method.

10.11 Mention the advantages and disadvantages of break even analysis.

11 Understand the concept of Marketing and inventory control

11.1 Define marketing.

11.2 Discuss the function of marketing.

11.3 State the objectives of marketing.

11.4 Explain the terms :

- Brand
- Producer
- Consumer
- Customer
- Copyright
- Trade mark

11.5 Discuss product life-cycle and marketing strategies in different stages of a product life-cycle

11.6 Define purchasing

11.7 Describe the five "R" of purchasing principles

12 Understand the concept of trade union and industrial law

- 12.1 Define trade union.
- 12.2 Mention the objectives of trade union.
- 12.3 Discuss the function of trade union.
- 12.4 Describe different types of trade union.
- 12.5 Mention the names of major trade union in Bangladesh.
- 12.6 Define labour and industrial law.
- 12.7 Discuss the importance of labour and industrial law.
- 12.8 Explain the terms :
 - Factory Act. (1965)
 - Minimum Wage Act (1957).
 - Industrial Disputes Act.
 - Work Men Compensation Act.
 - Trade Union Act.