

AIMS

After completion of the course the students will be able.

- to understand the foundation and foundation engineering.
- to understand the soil stabilization.
- to understand the bearing capacity of soil.
- to understand the factors determining types of foundation.
- to understand the foundation on sand and non-plastic soil, plastic soil, non-uniform soil, rock.
- to understand the excavating and bracing.
- to understand the sheet pile wall, cofferdam and bulk head.
- to understand the damages due to construction operations.

SHORT DESCRIPTION

Foundation and foundation engineering; Soil stabilization; Bearing capacity of soil; Factors determining the types of foundation; Foundation on sand and non-plastic silt; Foundation on clay and plastic silt; Foundation on non-uniform soil; Foundation on rock; Excavation and bracing; Sheet pile, cofferdam & bulkhead; Damages due to construction operations.

DETAIL DESCRIPTION**Theory:**

- 1 **Understand the foundation and foundation engineering.**
 - 1.1 State the meaning of foundation and foundation engineering.
 - 1.2 Mention the requirements of a satisfactory foundation.
 - 1.3 Mention the classification of foundation.
 - 1.4 Mention the factors governing the depth of foundation.
- 2 **Understand the soil stabilization.**
 - 2.1 State the meaning of soil stabilization.
 - 2.2 Mention the various methods of soil stabilization.
 - 2.3 Describe the process of addition and removal of soil particles for soil stabilization.
 - 2.4 Describe the soil stabilization by drainage.
 - 2.5 Describe the process of sand piling.
 - 2.6 Describe the process of soil cement stabilization.
- 3 **Understand the bearing capacity of soil.**
 - 3.1 Define the bearing capacity of soil.
 - 3.2 Explain the ultimate bearing capacity of soil.
 - 3.3 Mention the Terzaghi's bearing capacity factors.
 - 3.4 Express the equations for determination of ultimate bearing capacity of soil for square and circular footing.
 - 3.5 Calculate the ultimate bearing capacity of sandy soil.
 - 3.6 Explain the allowable bearing capacity of clay.
 - 3.7 Explain the allowable bearing capacity of sand.
 - 3.8 Describe the method of plate bearing test.
 - 3.9 Calculate the allowable bearing capacity of soil.
 - 3.10 Explain the methods for improving bearing capacity of soil.
- 4 **Understand the pile.**
 - 4.1 Define pile.
 - 4.2 Classify pile.
 - 4.3 Differentiate precast & cast in situ pile.

- 4.4 Describe methods of cast in situ pile.
- 4.5 Describe method of precast pile.
- 4.6 Explain the bearing capacity of pile.
- 4.7 Describe the negative skin friction.
- 4.8 State the meaning of end bearing pile.
- 5 Understand anchors.**
 - 5.1 Define the ground anchors.
 - 5.2 Describe the anchor in sand.
 - 5.3 Describe the anchor in stiff clay.
 - 5.4 State the advantage of anchoring.
- 6. Understand the factors determining types of foundation.**
 - 6.1 Explain the steps in choosing types of foundation.
 - 6.2 Discuss the necessity of bearing capacity and settlement in choosing types of foundation.
 - 6.3 Describe the design loads as the factors in choosing types of foundation.
- 7 Understand the foundation on sand and non-plastic silt.**
 - 7.1 Mention the characteristics of sand and silt deposits.
 - 7.2 Explain footing on sand.
 - 7.3 Explain raft on sand.
 - 7.4 Describe the process of excavation in sand.
 - 7.5 Explain piles in sand.
 - 7.6 Explain piers on sand.
- 8 Understand the foundation on clay and plastic silt.**
 - 8.1 Mention the characteristics of clay and plastic silt deposits.
 - 8.2 Explain footing on clay.
 - 8.3 Explain raft on clay.
 - 8.4 Describe the process of excavation in clay.
 - 8.5 Explain piles in clay.
 - 8.6 State piers on clay.
 - 8.7 Explain settlement of foundations underlying by clay.
- 9 Understand the foundation on non-uniform soils.**
 - 9.1 Define the non-uniform soils.
 - 9.2 Describe the characteristics of soft or loose strata overlaying firm deposit.
 - 9.3 Explain the dense or stiff layer overlaying soft deposit as foundation material.
 - 9.4 Describe the characteristics of alternating soft and stiff layers.
 - 9.5 Describe the characteristics of irregular deposit.
 - 9.6 Describe the excavation in non-uniform soils.
 - 9.7 Describe the stability of slope in non uniform soils.
- 10 Understand the foundation on rock.**
 - 10.1 State the basis for design of foundation on rock.
 - 10.2 Explain foundation on un-weathered rock.
 - 10.3 Explain foundation on weathered rock.
 - 10.4 State the treatment of rock defects.
 - 10.5 Describe the process of excavation in rock.
- 11 Understand the excavating and bracing.**
 - 11.1 State open excavation with unsupported slope.
 - 11.2 Mention the necessity of sheeting and bracing.
 - 11.3 Describe sheeting and bracing for shallow excavation.
 - 11.4 Describe sheeting and bracing for deep excavation.
- 12 Understand the sheet pile, cofferdam and bulkhead.**
 - 12.1 State the meaning of sheet pile, coffer dam and bulk head.
 - 12.2 Mention the different types of sheet pile and bulkhead with sketches.
 - 12.3 State the forces action on a bulkhead.

- 12.4 Determine the embedded length of cantilever sheet pile in cohesive soil.
- 12.5 Determine the embedded length of cantilever sheet pile in non-cohesive soil.
- 12.6 Design an anchored bulkhead using free earth support method for:
 - a. Granular soil.
 - b. Cohesive soil below dredge line.
- 12.7 Solve problems relating cantilever sheet pile and anchored bulkhead.
- 13 Understand the damages due to construction operations.**
 - 13.1 State the settlement due to excavation.
 - 13.2 State the settlement due to vibration.
 - 13.3 Describe the settlement due to lowering the water table.
 - 13.4 State the displacement due to pile driving.

Practical:

- 1 Perform the stabilization of soil by cement-sand method.
- 2 Perform the stabilization of soil by sand pile method.
- 3 Determine the ultimate bearing capacity of soil by plate bearing test.
- 4 Determine the bearing capacity of a test pile.
- 5 Draw soil pressure diagram beneath the footing.
- 6 Prepare a model of pile foundation.
- 7 Prepare a model of raft foundation.
- 8 Prepare a model of pier foundation.
- 9 Practice to improve the bearing capacity of soil.
- 10 Perform the Standard Penetration Test (SPT).
11. Caculate load bearing capacity of precast pile
12. Caculate load bearing capacity of cast inside pile.
13. Perform field test of bearing capacity of soil as per manual.
14. Field visit.

REFERENCE BOOKS

- 1 Foundation Engineering
- Peck and Henson
- 2 Soil Mechanics & Foundation
- B.C Punmia
- 2 Foundation Engineering
- Leonard
- 3 Soil Mechanics
- Craig
- 4 Building Construction
- S.C Rangwala
- 5 LGED Manual for soil investigation

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SURVEYING – III

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AIMS

- To be able to set out different types of curve.
- To be able to understand triangulation survey
- To be able to conduct hydrographic survey.
- To be able to learn using total station,
- To be able to understand photogrammetry.
- To be able to conduct route survey.
- To be able to perform city survey.

SHORT DESCRIPTION

Curve ranging; Setting out Plan / alignment; Triangulation survey; Hydrographic survey; Total station; Photogrammetry; Route survey; City survey.

DETAIL DESCRIPTION

Theory:

1 Understand the concept of curve.

- 1.1 Define curve.
- 1.2 Explain the necessity of curve.
- 1.3 Classify different types of curve.
- 1.4 Describe circular curves.
- 1.5 Explain the nomenclature of simple curve.
- 1.6 List the elements of simple curve.
- 1.7 Express the deduction of formula for finding radius of a circular curve.
- 1.8 Express the deduction of formula for calculating different elements of simple curve.
- 1.9 Solve problem on different elements of simple curve.

2 Understand the concept of curve ranging.

- 2.1 State the meaning of curve ranging.
- 2.2 List the instrument required for curve ranging.
- 2.3 Classify different methods of curve ranging.
- 2.4 State the steps in curve ranging.
- 2.5 Describe the procedure of finding out deflection angle.
- 2.6 Describe the procedure of finding out deflection angle without using any angular instrument.
- 2.8 Describe the procedure of finding out the location of tangent point.
- 2.9 Explain the importance of peg interval.

3 Understand the procedure of setting out curves by linear methods.

- 3.1 Classify setting out curve by linear method.
- 3.2 Express the deduction of formula for setting out curve by ordinates from long chord.
- 3.3 Describe the procedure of setting out curve by ordinates from long chord.
- 3.4 Express the deduction of formula for setting out curve by offsets from tangent (radial method).
- 3.5 Express the deduction of formula for setting out curve by offsets from tangent (perpendicular method).
- 3.6 Describe the procedure of setting out curve by successive bisection of arcs.
- 3.7 Express the deduction of formula for setting out curve by offsets from chords produced method.
- 3.8 Solve problems on setting out of circular curves.
- 4 Understand the procedure of setting out curves by angular methods.**
 - 4.1 Describe the angular methods of curve ranging.
 - 4.2 Express the deduction of formula for setting out curve by one theodolite method
 - 4.3 Describe the procedure of setting out curve by one theodolite method (Digital/conventional).
 - 4.4 Describe the procedure of setting out curve by two-theodolite method (Digital/conventional).
 - 4.5 Solve problems on setting out curve by angular method.
- 5 Understand various obstacles in simple curve ranging.**
 - 5.1 List the common obstacles in curve ranging.
 - 5.2 Describe the procedure of overcoming the obstacles in curve ranging.
 - 5.3 Solve problems on obstacles in curve ranging.
- 6 Understand the concept of transition curve.**
 - 6.1 Define transition curve.
 - 6.2 Explain the necessity of transition curve.
 - 6.3 Mention the conditions of transition curve.
 - 6.4 Classify different types of transition curve.
 - 6.5 State the meaning of super elevation.
 - 6.6 Express the deduction of formula for calculating super elevation.
 - 6.7 Express the deduction of formula for calculating the length of transition curve as used in highways and railways.
 - 6.8 List the elements of transition curve.
 - 6.9 Define shift and spiral angle.
 - 6.10 Describe the procedure of setting out transition curve by tangential angle method.
 - 6.11 Solve problems on transition curves.
- 7 Understand the concept of vertical curve.**
 - 7.1 Define vertical curve.
 - 7.2 Classify different types of vertical curve with their purposes.
 - 7.3 Explain the necessity of vertical curve.
 - 7.4 Explain the properties of parabola.
 - 7.5 Describe the calculating process of setting out data for vertical curve.
 - 7.6 Describe the procedure of finding out the grade of an undulated proposed road.
 - 7.7 Describe the procedure of setting out vertical curves.
 - 7.8 Solve problem on vertical curve.

8 Understand the concept of setting out plan of a building / alignment of a road.

- 8.1 Explain the significance of setting out a plan of a building / alignment of a road.
- 8.2 List the instrument and accessories required for setting out works for building and road alignment.
- 8.3 Describe the procedure of fixing centre line of building / road.
- 8.4 Describe the procedure of providing reduce levels (RL's) on different parts of a building / road.

9 Understand the Concept of Geodetic survey.

- 9.1 Define geodetic survey
- 9.2 Describe the objective of Geodetic Survey and its Classification.
- 9.3 Describe the principles of triangulation survey.
- 9.4 Describe the objectives of triangulation survey.
- 9.5 Describe triangulation system with sketches.
- 9.6 Classify different types of triangulation system.
- 9.7 Describe the characteristics of different types of triangulation system.

10 Understand the concept of triangulation survey.

- 10.1 Name the steps in triangulation survey.
- 10.2 Explain the importance of reconnaissance survey in triangulation.
- 10.3 Describe the points to be considered for selecting station points in triangulation survey.
- 10.4 State the meaning of tower and signals in triangulation survey.
- 10.5 Determine the height of a tower in triangulation survey.
- 10.6 Describe the points to be considered for selecting base line in triangulation survey.
- 10.7 Describe the procedure of base line measurement in triangulation survey.
- 10.8 Solve problems on the length of base line correction.
- 10.9 Explain the procedure of measuring angles in triangulation survey.
- 10.10 Compute the length of other sides of the whole triangulation system.
- 10.11 State the meaning of reduction to centre.
- 10.12 Solve problems on reduction to center.

11 Understand the concept of hydrographic survey.

- 11.1 State the meaning of hydrographic survey.
- 11.2 Explain the purposes of hydrographic survey.
- 11.3 Define control for hydrographic surveys.
- 11.4 Describe shoreline survey and river survey.
- 11.5 List the equipment and accessories required for hydrographic survey.

12 Understand the procedure of sounding.

- 12.1 State the meaning of sounding.
- 12.2 Describe the duties of members of a sounding party.
- 12.3 Distinguish between shoreline and range line.
- 12.4 Describe the procedure of measuring sounding.
- 12.5 Mention the methods of locating sounding.
- 12.6 Explain the reduction of sounding.
- 12.7 Solve problems on reduction of sounding.
- 12.8 Describe the process of plotting of sounding.
- 12.9 Describe the procedure of solving three points problem.
- 12.10 State the meaning of a station pointer.

13 Understand the procedure of measuring discharge.

- 13.1 Mention the data required for measuring discharge.
- 13.2 Mention the uses of current meter.
- 13.3 Describe the calibration process of current meter.

- 13.4 Explain the methods of measuring velocity by current meter.
- 13.5 Describe the procedure of calculating discharge from the data obtained by current meter.
- 13.6 State the meaning of floats.
- 13.7 Explain the method of measuring velocity by floats.
- 13.8 Describe the procedure of calculating discharge from the data obtained by floats.
- 13.9 Mention the data and formula required for computing discharge through weirs.
- 13.10 Solve problems on measurement of discharge.

14 Understand the principles of operation and uses of total station.

- 14.1 State the meaning of total station.
- 14.2 Name the components of total station.
- 14.3 Mention the function of each of the components.
- 14.4 Mention the uses of total station.
- 14.5 Describe the procedural steps of setting total station.
- 14.6 List different types of adjustment.
- 14.7 Name the fundamental lines of total station.
- 14.8 Mention the relation among the fundamental lines.
- 14.9 Describe the procedure of taking readings with total station.

15 Understand the principles of making traverse with total station.

- 15.1 List the fieldworks involved in survey with total station.
- 15.2 Describe the procedure of measuring horizontal distance and vertical height with total station.
- 15.3 Describe the operational steps of traverse survey with total station.
- 15.4 Compute the Gale's traverse with the help of total station.
- 15.5 Describe the plotting of map of a traverse survey with total station.

16 Understand the concept of photogrammetry.

- 16.1 State the purpose of photogrammetry.
- 16.2 Mention the features of photo-theodolite.
- 16.3 State the purpose of aerial surveying.
- 16.4 State the following terms:
 - a. Vertical photograph
 - b. Tilted photograph
 - c. Focal length
 - d. Exposure station
 - e. Flying height
 - f. Primary camera station.

17 Understand the concept of route survey.

- 17.1 State the meaning of route survey.
- 17.2 Explain the series of work of route survey of a project.
- 17.3 Describe the reconnaissance survey of a project.
- 17.4 Describe the preliminary survey of a project.
- 17.5 List the instrument required for preliminary survey.
- 17.6 Name the different parties for preliminary survey and describe their works.
- 17.7 Describe the location survey of a project.
- 17.8 Describe the construction survey of a project.

18 Understand the procedure of city survey.

- 18.1 Explain the purpose of city survey.
- 18.2 List the maps required for city survey.
- 18.3 Describe the methods of establishing horizontal and vertical control.
- 18.4 List the instrument required for city survey.

- 18.5 Describe the method of preparing topographic map of a city.
- 18.6 Explain the objects of the property survey of a city.
- 18.7 Describe the method of preparing property map of a city.
- 18.8 Describe the method of preparing wall map of a city.
- 18.9 Describe the method of preparing underground map of a city.
- 18.10 Describe the method of locating details of a city.
- 18.11 Explain the system of preservation of detail notes of city survey.

Practical:

- 1 Prolong a straight line with theodolite.
- 2 Set out circular curve by offset from long chord method.
- 3 Set out circular curve by successive bisection of arc method.
- 4 Set out circular curve by offset from tangent (radial method).
- 5 Set out circular curve by offset from tangent (perpendicular method).
- 6 Set out circular curve by offset from chord produced method.
- 7 Set out circular curve by one theodolite method (Rankine method).
- 8 Set out circular curve by two theodolite method.
- 9 Perform layout plan of a building using theodolite.
- 10 Perform layout alignment of a highway.
- 11 Conduct hydrographic survey.
- 12 Perform river / canal cross section by sounding method.
- 13 Measure a base line and angles of a triangulation system and calculate rest of the sides.
- 14 Demonstrate the components of Total Station
- 15 Determine the horizontal and vertical distances with total station
- 16 Conduct traversing with a total station and plot map including computation of area.
- 17 Field visit

REFERENCE BOOKS

- | | | |
|---|---------------------------|----------------------|
| 1 | Surveying and levelling - | T P Kanetkar |
| 2 | Surveying | - Norman Thomas |
| 3 | Surveying | - Aziz and Shahjahan |

- 4 Plane and Geodetic Survey - D Clark
- 5 A Text book of Advanced Surveying- R. AGOR

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 alkalinity, 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:
 - a. Heating and boiling
 - b. pH control
 - c. Using oxidizing agent
 - d. Ultra violet Ray
 - e. 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-
 - a. Meter
 - b. Valves
 - c. Fire hydrant
 - d. 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-
 - a. handling and laying pipes and their maintenance
 - b. placing and maintenance of hydrants and valves
 - c. 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.**
 - 1.1 Identify physically different type of pipes, fittings and joints.
 - 1.2 Draw the sketches of typical plumbing 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 Demonstration of water purification plant and deep tube well.**
 - 2.1 Draw flow diagram of water purification processes after visiting a plant.
 - 2.2 Draw section through a deep tube well.
 - 2.3 Identify the major precautions needed during installation and use of deep tube well.
- 3 Maintenance works.**
 - 3.1 Identify, take out and replace unserviceable fixtures/ fittings or any other component parts.

- 3.2 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

REFERENCE BOOKS

1. Rangawala, S.C(2009): Water supply and sanitation. (Environmental Engineering)
2. Azizul, Syed Haq (2006): Plumbing Practices.
3. Feroze, M. Ahmed & Mujibur, M. Rahman (2000): WATER SUPPLY & SANITATION: RURAL AND LOW INCOME URBAN COMMUNITIES, ITN-BANGLADESH Publication.
4. Plumbing (1991): Technical Teachers Training College Publication.
5. Aziz, M.A (1975) : Water supply and sanitation.

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THEORY OF STRUCTURE

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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 of 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

AIMS

After completion of the course the students will be able

- to understand the construction process of arch and lintel.
- to understand the construction process of different types of floor.
- to understand the construction process of stairs.
- to understand the construction process of different types of roof.
- to understand the different finishing works in building.
- to understand the construction process of doors and windows.
- to understand the different operation and maintenance construction equipment.
- to understand the construction of bridge, culvert, canals etc.

SHORT DESCRIPTION

Arches; Lintels; Ground floors; Upper floors; Damp proofing; Termite treatment; Stairs; Roof; Pitched roof; Plastering and pointing; Doors; Windows; Carpentry and joinery; Scaffolding; Form works, Pointing & Varnishing, construction equipment, Building Services, Insulation, bridge/culverts and canals etc.

DETAIL DESCRIPTION**Theory:**

- 1 Understand the different type of arches and lintels.**
 - 1.1 State the meaning of arch and lintel.
 - 1.2 Mention the functions of arch and lintels.
 - 1.3 List the common terms used in arches and lintels.
 - 1.4 Mention the different type of arches according to their shape, center and material.
 - 1.5 Describe the correct procedures of construction of arches and lintels.
- 2 Understand the floor.**
 - 2.1 State the meaning of floor.
 - 2.2 Mention the components of a floor.
 - 2.3 Mention the essential requirements of a floor.
 - 2.4 Name the suitable materials used for the construction of floor.
 - 2.5 Describe the construction procedure of the following type of 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
 - k. Solid floor
 - l. Hollow floor
 - m. Composite floor
- 3 Understand the dampness of building.**
 - 3.1 Mention the causes of dampness in building.
 - 3.2 Mention the ill effects of dampness in building.
 - 3.3 Describe the methods of damp proofing of building.

- 3.4 Define efflorescence.
- 3.5 Describe remedial measures against efflorescence.
- 3.6 Mention the requirements of an ideal damp proofing materials.
- 3.7 Describe the damp proof course (DPC) treatment for basement and wall on undrained soil with sketches.
- 3.8 Describe the DPC treatment for basement and wall in damp soil with sketches.
- 3.9 Mention the function of PVC felt used in basement.
- 3.10 State the function of rubber stopper to prevent the leakage of water.

4 Understand the damages due to termite in building.

- 4.1 Identify different type of termites.
- 4.2 Explain the damages due to termite in building on economic point of view.
- 4.3 Name the chemicals used for anti-termite treatment.
- 4.4 Describe the methods of pre-construction anti-termite treatment.
- 4.5 Describe the methods of post-construction anti-termite treatment.

5 Understand the 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 requirements of a good stair.
- 5.6 Express the relationship between tread and riser.
- 5.7 List the suitable materials for construction of stairs.
- 5.8 Mention the classification of stairs.
- 5.9 Plan a staircase for a building from a given stair hall and room height.

6 Understand the roofs.

- 6.1 List the different kind of roofs.
- 6.2 Mention the functions 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 roofs.
- 6.6 Compare the advantages and limitations of flat roof over pitched roof.
- 6.7 Describe the construction procedure of a lean-to-roof.
- 6.8 Distinguish between king post truss and queen post truss.
- 6.9 Mention the advantages of steel trusses over wooden trusses.

7 Understand the plastering and pointing.

- 7.1 Classify the various types of plaster.
- 7.2 Describe the various types of plaster on the basis of their suitability and uses.
- 7.3 Name the different kinds of pointing with sketches.
- 7.4 State the purpose of plastering and pointing.
- 7.5 Mention the common tools used for plastering and pointing works with their functions.
- 7.6 Describe the process of applying plaster on a new and old surface.
- 7.7 Mention the common defects in plastering and pointing.
- 7.8 State how the defects of plastering and pointing can be rectified.
- 7.9 Describe the process of pointing works.
- 7.10 Distinguish between plastering and pointing.

8 Understand the doors.

- 8.1 List different type of doors.
- 8.2 Identify the technical terms used in doors.
- 8.3 Mention the factors to be considered in determining the size, shape, location and number of doors in a room.
- 8.4 Describe the various type of doors on the basis of their suitability and uses.
- 8.5 Mention the advantages and limitations 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 sheet door
 - k. Plastic door
 - l. Aluminum door
- 8.6 Describe the methods of fixing door frames.

9 Understand the windows.

- 9.1 List different type of windows.
- 9.2 Mention the factors to be considered to determine the size, shape, location and number of windows in a room.
- 9.3 Describe the various type of windows on the basis of their suitability and uses.
- 9.4 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. Gable window
 - l. Lantern window
 - m. Aluminum window
- 9.5 State the functions of skylight, sunlight, fanlight and ventilator.
- 9.6 Describe the methods of fixing windows.
- 9.7 Compare among the wooden, steel and aluminum glazed window.

10 Understand the concept of carpentry and joineries used in building construction.

- 10.1 Distinguish between carpentry and joinery.
- 10.2 Differentiate between temporary and permanent carpentry.
- 10.3 Identify various type of joints used in wood works.
- 10.4 Identify various type of lengthening joints.
- 10.5 Mention the suitability of the following joints with typical dimensions:
 - a. Dove tail joint
 - b. Tennon and mortise joint
 - c. Bridle joint

- d. Oblique tennon joint
- 10.6 Describe the importance of fastenings used in wood works.
- 10.7 Identify the defective joints and bad workmanship.

11 Understand the importance of scaffolding.

- 11.1 State the meaning of scaffolding.
- 11.2 Explain the necessity and uses of scaffolding.
- 11.3 Name the different components of scaffolding.
- 11.4 Describe different types of scaffolding.
- 11.5 Compare the advantages and limitations of timber scaffolding over steel scaffolding.
- 11.6 Differentiate between shoring and scaffolding.
- 11.7 Describe the safety requirements for scaffolding works.

12 Understand the significance of form works.

- 12.1 State the meaning of form works.
- 12.2 Define centering and shuttering.
- 12.3 Explain the necessity and uses of form works.
- 12.4 Name the different components of form works.
- 12.5 Mention the essential requirements of a good form work.
- 12.6 Describe the process of making form works of the followings:
 - a. Column
 - b. Beam and slab
 - c. Stair
 - d. Wall.
- 12.7 Describe the specifications for cleaning & treatment of forms and scrapping of form works.
- 12.8 Analysis the behavior and results of various loads on form works.
- 12.9 Describe the removal technique of form works.
- 12.10 Describe the methods for fair face concreting.

13 Understand the process of painting & Varnishing.

- 13.1 State the purpose of painting & varnishing.
- 13.2 Name the ingredients of paint & varnishes.
- 13.3 Mention the specific function of each ingredient of paint & varnishes.
- 13.4 Describe the characteristics of good paints & varnishes.
- 13.5 State the various defects in painting & varnishing.
- 13.6 Describe the factors that should be considered during the supervision of quality painting & varnishing work.
- 13.7 Differentiate between the properties and ingredients of the following:
 - 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
- 13.8 Describe the procedure of application of the following on new and old specific surfaces:
 - a. white wash
 - b. color wash
 - c. distemper
 - d. weather coat
 - e. snowcem(cement based paint)
 - f. plastic emulsion paint
 - g. synthetic enamel paint.

14 Understand the necessity of equipment in construction works.

- 14.1 List the equipment required for construction works.
- 14.2 Mention the specific use of the each equipment required for construction works.
- 14.3 Describe the operation and maintenance of different pumps used in construction works.
- 14.4 Describe the operation and maintenance of earth excavating machine.
- 14.5 Describe the operation and maintenance of bulldozer machine.
- 14.6 Describe the operation and maintenance of roller machine.
- 14.7 Describe the operation and maintenance of brick cutter machine.
- 14.8 Describe the operation and maintenance of crushing (brick/stone) machine.
- 14.9 Describe the operation and maintenance of concrete mixture machine.
- 14.10 Describe the operation and maintenance of concrete pump machine.
- 14.11 Describe the operation and maintenance of concrete hoisting equipment.
- 14.12 Describe the operation and maintenance of different conveyor used in construction works.
- 14.13 State the function of vibrator machine.
- 14.14 Mention various types of vibrator machine with their suitability of uses.

15 Understand the necessity of different building services.

- 15.1 State the necessity of different building services.
- 15.2 Classify different kinds of building services.
- 15.3 Describe the procedure of gas line installation in building.
- 15.4 Describe the layout of electrical wiring with various fittings in building.
- 15.5 Describe the process of installation of mechanical ventilation and air-conditioning system in building.
- 15.6 Describe the method of installation of elevator or lift and escalator system in a building.
- 15.7 Describe the fire protection system in a building.

16 Understand building codes and building by laws.

- 19.1 State different codes followed in construction methodology.
- 19.1 State the main features of Bangladesh National Building Code(BNBC),1993 with latest update in construction industry.
- 19.1 Define building bye laws.
- 19.1 Explain the municipal regulation in building planning.
- 19.1 Describe the importance of building bye laws.
- 19.1 Describe the economical planning of a residential building.
- 19.1 Define orientation of a building
- 19.1 Describe the effects of orientation of building on the basis of local climates.

17 Understand the different insulation in building.

- 17.1 Define thermal and sound insulation.
- 17.2 State the necessity of thermal and sound insulation in building.
- 17.3 List various types of materials used for thermal and sound insulation.
- 17.4 Describe the general methods of thermal and sound insulation in building.
- 17.5 Describe the process of thermal insulation of the following with neat sketches:
 - a. floor
 - b. roof
 - c. exposed wall
 - d. exposed door and window.

18 Understand the construction process of dam and embankment.

- 18.1 Define dam and embankment.
- 18.2 State the necessity of dam and embankment.
- 18.3 Describe the procedure of selection of alignment.
- 18.4 Describe the factors to be considered in designing dam and embankment.
- 18.5 Describe the process of maintenance of dam and embankment.

19 Understand the construction process of irrigation and drainage canal.

- 19.1 Define irrigation and drainage canal.
- 19.2 Describe the factors to be considered in designing irrigation and drainage canal.
- 19.3 Design an irrigation and drainage canal.
- 19.4 Describe the procedural steps of construction of irrigation and drainage canal.
- 19.5 Describe the process of maintenance of irrigation and drainage canal.

20 Understand the construction process of bridge and culvert.

- 20.1 State different types of bridge and culvert.
- 20.2 Mention different components of bridge and culvert.
- 20.3 Describe the process of setting out plan of bridge and culvert.
- 20.4 Describe the procedural steps of construction of bridge and culvert.
- 20.5 Explain the necessity of inspection of bridge and culvert for maintenance.
- 20.6 Describe the factors to be considered for inspection of bridge and culvert.

Practical:

1 Construct a semi-circle/segmental brick arch.

- 1.1 Select the required tools and raw materials.
- 1.2 Make form works with suitable materials.
- 1.3 Prepare cement mortar as required.
- 1.4 Place the bricks on proper position with cement mortar.
- 1.5 Do the curing of the brick work properly.
- 1.6 Remove the form works.

2 Construct any 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
- 3.1 Select the required tools and raw materials.
- 3.2 Prepare the floor according to standard specification.
- 3.3 Clean the work site.

3 Perform a case study of dampness in building.

- 3.1 Identify a damped building.
- 3.2 Investigate the reasons of dampness.
- 3.3 Select the method of damp proofing.
- 3.4 Estimate the materials to be needed for damp proofing.
- 3.5 Prepare a report on the specified case of dampness in building.

4 Construct the form work of a stair.

- 4.1 Collect the required tools and raw materials.
- 4.2 Draw a neat sketch of stair (at least ten nos. steps).

- 4.3 Make the bottom supports and erect inclined way.
- 4.4 Fix the steps and side of steps.
- 4.5 Check the accuracy of the works.

5 Construct a wooden lean-to-roof.

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

6 Construct a wooden king post roof truss.

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

7 Construct a wooden queen post roof truss.

- 7.1 Collect the required tools and raw materials.
- 7.2 Draw the neat sketch with dimensions of a queen post roof truss.
- 7.3 Make the joints and assemble the members.
- 7.4 Erect the queen post roof truss in proper position.
- 7.5 Check the accuracy of the work.

8 Perform cement plastering to brick walls.

- 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 Provide dots and check the thickness of cement plaster.
- 8.8 Provide the screed properly.
- 8.9 Apply mortar (top to bottom and left to right).
- 8.10 Plain / level the surface as possible.
- 8.11 Check the surface accordingly.
- 8.12 Do the curing as required.

9 Perform pointing works to a boundary wall.

- 9.1 Collect the required tools and raw materials.
- 9.2 Clean the loose materials from the surface.
- 9.3 Raking out all the joints upto required depth.
- 9.4 Wash the surface with water.
- 9.5 Mix(dry) cement-sand in required proportion.
- 9.6 Add water to dry mix with maintaining water-cement ratio.
- 9.7 Apply mortar to the joints and press (top to bottom and left to right).
- 9.8 Draw the tools accordingly.
- 9.9 Check the joints accordingly.
- 9.10 Do the curing as required.

10 Construct a single layer and double layers scaffolding.

- 10.1 Collect the required tools and raw materials.
- 10.2 Erect the vertical members.
- 10.3 Place the horizontal members and tied with jute rope.

- 10.4 Place the boards for platform.
- 10.5 Provide the bracings accordingly.
- 10.6 Check the properness of the scaffolding work.
- 10.7 Disassemble all the members and store the materials used.
- 11 Prepare form works for columns and beams.**
 - 11.1 Collect the required tools and raw materials.
 - 11.2 Make the boards according to required size.
 - 11.3 Erect the boards and attached accordingly so that they can easily remove.
 - 11.4 Check the dimensions of the column/beam.
 - 11.5 Disassemble the form works and store the materials used.
- 12 Perform white washing on new and old surface.**
 - 12.1 Collect the required tools and raw materials.
 - 12.2 Prepare the surface as necessary.
 - 12.3 Prepare white wash as required.
 - 12.4 Apply first coat of white wash and allow to drying.
 - 12.5 Apply second coat of white wash and allow to drying.
 - 12.6 Apply the final coat of white wash.
- 13 Perform color washing on new and old surface.**
 - 13.1 Collect the required tools and raw materials.
 - 13.2 Prepare the surface as necessary.
 - 13.3 Prepare color wash as required.
 - 13.4 Apply first coat of color wash and allow to drying.
 - 13.5 Apply second coat of color wash and allow to drying.
 - 13.6 Apply the final coat of color wash.
- 14 Perform distemping on new and old surface.**
 - 14.1 Collect the required tools and raw materials.
 - 14.2 Prepare the surface as necessary.
 - 14.3 Prepare distemper as required.
 - 14.4 Apply first coat of distemper and allow to drying.
 - 14.5 Apply second coat of distemper and allow to drying.
 - 14.6 Apply the final coat of distemper.
- 15 Perform snowcem washing and weather coating on new and old surface.**
 - 15.1 Collect the required tools and raw materials.
 - 15.2 Prepare the surface as necessary.
 - 15.3 Prepare paint as required.
 - 15.4 Apply first coat of paint and allow to drying.
 - 15.5 Apply second coat of paint and allow to drying.
 - 15.6 Apply the final coat of paint.
- 16 Perform plastic emulsion painting on new and old surface.**
 - 16.1 Collect the required tools and raw materials.
 - 16.2 Prepare the surface as necessary.
 - 16.3 Prepare paint as required.
 - 16.4 Apply first coat of paint and allow to drying.
 - 16.5 Apply second coat of paint and allow to drying.
 - 16.6 Apply the final coat of paint.
- 17 Perform varnishing on new and old wooden surface.**
 - 17.1 Collect required tools and raw materials.

- 17.2 Prepare the surface as necessary.
 - 17.3 Prepare varnish as required.
 - 17.4 Apply first coat and allow to drying.
 - 17.5 Apply second coat and allow to drying.
 - 17.6 Apply the final coat of varnish.
- 18 (a) Draw plan and sectional elevation of on irrigative and drainage canal.
 - (b) Prepare a typical model of a drainage canal with suitable materials.
 - 19 (a) Draw plan and sectional elevation of a RCC bridge or culvert.
 - (b) Prepare a typical model of a RCC bridge with or culvert suitable materials.
 - 20 Make a site visit/field trip.

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 and Foundation Engineering
- Dr. J Jha, S K Sinha
- 6. Building Construction
- Shushil Kumar

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.
- Carbon cycle
 - Nitrogen cycle
 - Phosphorus cycle
 - Sulphur cycle.
 - 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.

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

4 Understand the air pollution and its sources & effects.

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

5 Understand the control of air pollution at the sources.

- Mention the methods of air pollution control.
- 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.

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

7 Understand the monitoring of water pollution.

- Define the following terms:
 - Dissolved oxygen (DO).
 - Biochemical oxygen demand (BOD).
 - Chemical oxygen demand (COD).
 - Total organic carbon (TOC).
 - Threshold limit value (TLV).
- 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.

REFERENCE BOOKS

১. পরিবেশ দূষণ (১ম ও ২য় খন্ড) — আবদুল মালেক ভূইয়া — গৌতম পাল
২. বিপন্ন পরিবেশ ও বাংলাদেশ — ডঃ এফ এম মনিরুজ্জামান
৩. বায়ু ও পানি দূষণ এবং প্রতিকার — মুহাম্মদ কাউছার হাবিব ভূইয়া
৪. পরিবেশ বিজ্ঞান — মুহাম্মদ কাউছার হাবিব ভূইয়া
৫. শব্দ ও তেজস্ক্রিয় দূষণ এবং প্রতিকার — মুহাম্মদ কাউছার হাবিব ভূইয়া
৬. মাটি ও তেজস্ক্রিয় দূষণ এবং প্রতিকার — মুহাম্মদ কাউছার হাবিব ভূইয়া
7. Pollution control in process industries — S. P. Mahajan
8. Environmental Engineering — Peavy, Rowe and Techobanglous
9. Air pollution — V. P. Kudesia
10. Industrial Noise Control — Bruce Fader
11. Pesticide Pollution — Kudecsia and Charaya
12. Water Pollution — V. P. Kudesia
13. Peoples Report on Bangladesh Environment 2001
Atia Rahman, M. Ashraf Ali and Farooque Choudhury

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.