



**BANGLADESH TECHNICAL EDUCATION BOARD**

Agargoon, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM  
SYLLABUS (PROBIDHAN-2016)

# **CONSTRUCTION TECHNOLOGY**

TECHNOLOGY CODE: **688**

4th SEMESTER

## DIPLOMA IN ENGINEERING

PROBIDHAN-2016

**CONSTRUCTION TECHNOLOGY (688)****4<sup>th</sup> SEMESTER**

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68841	Working & Structural Drawing	1	3	2	20	30	25	25	100
2	68842	Construction Surveying-2	3	3	4	60	90	25	25	200
3	68843	Building Facilities & Services	2	3	3	40	60	25	25	150
4	68844	Hydrology & Water Resources Engineering	2	3	3	40	60	25	25	150
5	66441	Structural Mechanics	2	3	3	40	60	25	25	150
6	66445	Geotechnical Engineering	2	3	3	40	60	25	25	150
7	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
<b>Total</b>			<b>14</b>	<b>18</b>	<b>20</b>	<b>280</b>	<b>420</b>	<b>150</b>	<b>150</b>	<b>1000</b>

**AIMS**

To provide knowledge, skill and attitude in the area of drawing with special emphasis on:

- Understanding the code and symbols used in construction engineering drawing.
- Developing knowledge, skill and attitude of detail drawing of building components and production drawing of a multi storied building.
- Interpreting the structural drawings of a multi storied building.
- Interpreting the structural drawing of bridge and culverts.
- Developing knowledge and skill to prepare detail working drawing of Roof top water tank, underground water tank, septic tank and soak well.
- Interpreting the structural drawing of pile and pile cap.

**SHORT DESCRIPTION**

Code and symbol, pile & road, Feature of multi-storied building, RCC lintel, RCC cantilever retaining wall, Detail drawing of foundation, Underground water reservoir and septic tank, two span box culvert, Interpretation supplied Drawing.

**DETAIL DESCRIPTION****Theory:****1. Understand the use and necessity of code and symbols in drawing.**

- 1.1 Define the terms code and symbols.
- 1.2 Mention the use of code and symbols in drawing.
- 1.3 Explain the necessity of code and symbols in drawing.
- 1.4 Explain the necessity of covering for steel reinforcement according to Code.
- 1.5 Describe the significance of minimum thickness of structural member according to code.
- 1.6 Explain the necessity of hooks, bend and lapping as per code.
- 1.7 Define construction joint and expansion joint as per code.

**2. Understand the preparation of detailed drawing of pile and RCC Road.**

- 2.1 Define the terms pile and pile cap.
- 2.2 Identify different types of pile.
- 2.3 Preparation of a detailed drawing of pile and pile cap.
- 2.4 Draw a neat sketch of right of way.
- 2.5 Identify different components of a RCC road.

**3. Understand the features of multi-storied building.**

- 3.1 Define multi storied building.
- 3.2 Mention the components of multi-storied building.
- 3.3 Mention the disadvantages of multi-storied building.
- 3.4 Describe the main features of a multi storied building.
- 3.5 List the drawings of a multi-storied building necessary for approval of the Relevant authorities.

**4. Understand the preparation of the working drawing of RCC lintel with Sunshade.**

- 4.1 Describe the process of making the detailed drawing of RCC lintel showing the reinforcement.
- 4.2 Describe the process of making the detailed drawing of RCC lintel with Sunshade showing of reinforcement.

**5. Understand the preparation of elevation and cross section of RCC Cantilever retaining wall.**

- 5.1 Describe the process of making the detail elevation of RCC retaining wall showing curtailment of reinforcement.

- 5.2 Describe the process of drawing the cross section of RCC retaining wall.
- 5.3 Describe the process of drawing the counter fort details showing Reinforcement including retaining wall.

**6. Understand the preparation of detailed drawing of foundation.**

- 6.1 Describe the process of drawing the spread footing foundation.
- 6.2 Describe the process of drawing the raft foundation showing the Reinforcement detail.
- 6.3 Describe the process of drawing the plan and sectional elevation of pile Showing the reinforcement detail.
- 6.4 Describe the process of drawing the plan and sectional elevation of pile Cap showing the reinforcement detail.

**7. Understand the preparation of plan and sectional elevation of Underground water reservoir and septic tank.**

- 7.1 Describe the process of drawing of plan and sectional elevation of an Underground water reservoir showing the reinforcement.
- 7.2 Describe the process of drawing of plan and sectional elevation of a Septic tank.
- 7.3 Describe the process of drawing the plan section of soak pit and Inspection pit.

**8. Understand the preparation of detail drawing of two span box culverts.**

- 8.1 Describe the process of drawing the sectional plan of a two span RCC Box culvert.
- 8.2 Describe the process of drawing the cross section of a two span RCC Box culvert.
- 8.3 Describe the process of drawing the long section of a two span RCC Box culvert.
- 8.4 Describe the process of showing the arrangement of reinforcement in a Two span RCC box culvert.

**9. Understand the interpretation of the supplied drawing.**

- 9.1 State the meaning of interpretation.
- 9.2 Mention the importance of interpretation of drawing.
- 9.3 Explain the necessity of interpretation of the architectural drawing of multi-storied building.
- 9.4 Explain the necessity of interpretation of the structural details of multistoried building.
- 9.5 Explain the necessity of interpretation of the plumbing and electrical Drawing of a multi storied building.

**PRACTICAL:**

1. Draw the cross section of a R.C.C Beam with reinforcement details.
2. Draw the cross section of a R.C.C Column with reinforcement details.
3. Draw the cross section of a R.C.C Lintel with sunshade showing reinforcement details.
4. Draw the cross section of a R.C.C Cantilever retaining wall with reinforcement details.
5. Draw Plan and cross section of a slab with reinforcement details.
6. Draw Plan and cross section of a R.C.C isolated column footing with reinforcement details.
7. Draw Plan and cross section of a R.C.C combined footing with reinforcement details.
8. Draw Plan and cross section of a septic tank with reinforcement details.
9. Draw Plan and cross section of a Soak well with reinforcement details.
10. Draw Plan and cross section of a Box culvert with reinforcement details.
11. Draw Plan and cross section of a pile including pile cap with reinforcement details.

**REFERENCE BOOK:**

Civil Engineering Drawing - Gurcharan Singh & Subhash Chander

**AIMS:**

To provide knowledge, skill and attitude in the area of surveying with special emphasis on:

- curve ranging.
- Topographic surveying.
- Traversing and tachometric surveying.
- surveying by using modern instruments (total station, EDM, GPS).
- Route and city survey.

**SHORT DESCRIPTION**

Curve Ranging, Transition Curve, Vertical Curve, Topographic Survey, Theodolite surveying, Traversing, Tachometric surveying, Surveying by using modern survey Instruments, Project surveying, Route survey, city survey, Mine surveying.

**DETAIL DESCRIPTION****Theory:****1. Understand the basic concept of curve and curve ranging.**

- 1.1 Define curve with its necessity and classification.
- 1.2 List the elements of a simple curve.
- 1.3 Express the deduction of formula for finding radius of a circular curve.
- 1.4 Express the deduction of formula for calculating different elements of a simple curve.
- 1.5 Mention the meaning of curve ranging.
- 1.6 List the instruments required for curve ranging.
- 1.7 Mention the classification of the method of curve ranging.
- 1.8 Procedure of curve ranging.
- 1.9 Describe the procedure of finding out deflection angle with and without any angular instrument.
- 1.10 Describe the procedure of finding out the location of a tangent point.

**2. Understand the setting out curves.**

- 2.1 Mention the classification of setting out of curve by linear method.
- 2.2 Express the deduction of formula for setting out curve by ordinates from long chord.
- 2.3 Describe the procedure of setting out curve by ordinates from long chord.
- 2.4 Express the deduction of formula for setting out curve by offsets from tangent (radial & perpendicular method).
- 2.5 Describe the procedure of setting out curve by bisection of arcs.
- 2.6 Describe angular methods of curve ranging.
- 2.7 Express the deduction of formula for setting out curve by one & two theodolite method.
- 2.8 Solve problems on setting out curve by linear and angular method.

**3. Understand the concept of transition curve.**

- 3.1 Define transition curve with its necessity and classification.
- 3.2 Mention the condition of transition curve.
- 3.3 State the meaning of super elevation with its necessity.
- 3.4 Express the deduction of formula for calculating super elevation.
- 3.5 Express the deduction of formula for calculating the length of transition curve used in highways and railways.
- 3.6 Define different elements of transition curve.
- 3.7 Describe the procedure of setting out transition curve by tangential angle method.
- 3.8 Solve problems on transition curves.

#### **4. Understand the concept of vertical curve**

- 4.1 Define vertical curve with its necessity and classification.
- 4.2 Interpret the formulas for calculating different elements of curve.
- 4.3 Describe the procedure of setting out vertical curves.
- 4.4 Solve problems on vertical curves.

#### **5. Understand the concept of topographic survey.**

- 5.1 Mention the meaning of topographic survey and the relief.
- 5.2 Describe the methods of representation of relief.
- 5.3 Describe the procedure of topographic survey.
- 5.4 Explain the method of locating horizontal and vertical control.
- 5.5 Describe the procedure of plotting a topographic map.

#### **6. Understand the concept of theodolite surveying.**

- 6.1 Define transit and non- transit theodolite.
- 6.2 Identify the common parts of a transit theodolite and their functions.
- 6.3 Define face left and face right.
- 6.4 Identify different type of adjustment of theodolite.
- 6.5 State different steps of temporary adjustment of theodolite
- 6.6 Mention relationship among the fundamental line of theodolite.
- 6.7 Mention the procedure of measuring horizontal and vertical angle with theodolite.

#### **7. Understand the basic concept of trigonometrically leveling.**

- 7.1 Explain basic principle of trigonometrical leveling.
- 7.2 Express the deduction of the formula for measuring height and horizontal distance when the object is accessible.
- 7.3 Express the deduction of the formula for measuring height and horizontal distance when the object is inaccessible in the case of object and station are in different levels.
- 7.4 Solve problems on finding heights and distance.

#### **8. Understand basic concept of traverse surveying.**

- 8.1 Define traverse.
- 8.2 Describe traversing by methods of included angles and direct angle.
- 8.3 Explain the process of plotting a traverse.
- 8.4 Find the bearing and coordinates of a traverse.
- 8.5 Prepare the Gale's traverse table.
- 8.6 State the Bowditch's rule and transit rule.
- 8.7 Describe the balancing the closed traverse.
- 8.8 Common errors and mistakes and their sources and way to avoid in theodolite traverse works.
- 8.9 Solve problems on traversing.

#### **9. Understand the operation and use of electronic distance meter (EDM).**

- 9.1 Identify the components of EDM.
- 9.2 Mention the advantages of EDM.
- 9.3 Mention the operational steps of setting of EDM.
- 9.4 Mention the procedures in conducting traverse survey with EDM.
- 9.5 Describe the procedure of plotting map.

#### **10. Understand the operation and use of total station.**

- 10.1 Identify the components of total station and their functions.
- 10.2 Mention the uses of total station.
- 10.3 Mention relationship among the fundamental lines of total station.
- 10.4 Mention the operational steps of setting of total station.
- 10.5 Mention the procedures in conducting traverse survey with total station.
- 10.6 Describe the procedure of measuring horizontal distance, vertical height, and area with total station.

10.7 Describe the procedure of plotting map with total station.

**11. Understand the principles of operation and uses of GPS.**

11.1 State the meaning of GPS.

11.2 Identify the components of GPS and their function.

11.3 Mention the uses of GPS.

11.4 Mention the operational steps of setting of GPS.

11.5 Describe the procedure of finding co-ordinates (latitude and longitude) of a station using GPS.

11.6 Describe the procedure of preparation of a map using mapping software and data received with GPS.

**12. Understand the concept of route survey.**

12.1 State route survey.

12.2 Explain the series of work of route survey of a project.

12.3 Describe the reconnaissance survey of a project.

12.4 Describe the preliminary survey of a project.

12.5 List the instrument required for preliminary survey.

12.6 Describe the construction survey of a project.

**13. Understand the procedure of city survey.**

13.1 Mention the purpose of city survey.

13.2 List the maps required for city survey.

13.3 Describe the methods of establishing horizontal and vertical control.

13.4 List the required mention maps for city survey.

13.5 Describe the method of preparing topographic map of a city.

13.6 Explain the objects of the property survey of a city.

13.7 Describe the method of locating details of a city.

**14. Understand the concept of mine surveying.**

14.1 Define mine surveying.

14.2 Explain the purpose of mine surveying.

14.3 Mention the difficulties in mine surveying.

14.4 Explain the following terms:

a. Station and station markers

b. Illumination

c. Surface survey

d. Bearing of a drift

14.5 List the equipment and instruments required for mine surveying.

14.6 Explain the following terms:

a. Tunnel survey

b. Surface survey

c. Sight pole

d. Suspension mining compass

**15. Understand the principles of Geographic Information System (GIS) and Real Time Kinematic (RTK)**

15.1 Explain Geographic Information System (GIS).

15.2 Explain Real Time Kinematic (RTK) .

15.3 Describe advantages of GIS and RTK.

15.4 Mention Major application of GIS and RTK.

15.5 Describe Basic functions of GIS and RTK.

## **PRACTICAL:**

1. Set out circular curve by offset from long chord method.
2. Set out circular curve by offset from tangent (radial method).
3. Set out circular curve by offset from tangent (perpendicular method).
4. Set out circular curve by offset from chord produced method.
5. Set out circular curve by one theodolite method (Rankin method).
6. Set out circular curve by two theodolite method.
7. Conduct traversing with a total station and plot map including computation of area.
8. Perform layout alignment of a highway.
9. Determine horizontal and vertical distances using total station.
10. Find co-ordinates (latitude and longitude) of a station using GPS
11. Prepare a map using mapping software and data received with GPS.
12. Demonstrate the components of Total Station
13. Perform a topographic survey using total station in your own institute.

## **REFERENCE BOOKS**

1. Surveying and Leveling- T. P. Kanatker
2. Surveying- Aziz & Shahjahan
3. Surveying- B. C. Punmia
4. Advanced surveying-GB Deshpande
  - AS Shelar
  - MV Jadvan



**AIMS:**

- To 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 necessity of lift, escalator and Building security.

**SHORT DESCRIPTION:**

Types of building facilities; Building automation and controls; Water supply and Heating, ventilation and air conditioning (HVAC) system in building; Gas supply and control; Light control or illumination system; Electricity supply control; Acoustics control; Lift and escalator; Building security system (alarming system CCTV); Communication system (CATV, telephone, intercom); Fire system.

**DETAIL DESCRIPTION****Theory:****1. Understand different building facilities.**

- 1.1 Define building facilities.
- 1.2 List the types of Building.
- 1.3 Explain the necessity of different facilities in building.
- 1.4 Describe the scope of building facilities.

**2. Building automation and controls.**

- 2.1 Understand the need to control the building.
- 2.2 State the meaning building automation.
- 2.3 Contact with different concepts of building automation
  - a) Water supply and Heating, Ventilation, and Air conditioning (HVAC system)
  - b) Gas supply and Control
  - c) Light control or illumination System
  - d) Electricity supply control
  - e) Acoustics Control
  - f) Lift and Escalator
  - g) Building Security system
  - h) Communication system and control
  - i) Fire Systems
- 2.4 Identify the following content for automation.
  - a) Sensors,
  - b) Controllers

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

- 3.1 Define hot and cold water supply system.
- 3.2 List the types of system.
- 3.3 Describe the direct and indirect cold-water system.
- 3.4 Describe the direct and indirect hot-water system.
- 3.5 Describe with sketches the followings:
  - (a) Water-storage cistern.
  - (b) Indirect hot-water cylinders.
- 3.6 Differentiate between single and dual supply system.

**4. Understand ventilation in building.**

- 4.1 Define ventilation.
- 4.2 State the necessity of ventilation.
- 4.3 Functional requirements of ventilation system.
- 4.4 Explain the natural ventilation.
- 4.5 Explain the mechanical ventilation.

**5. Understand air conditioning in building.**

- 5.1 Define air conditioning.
- 5.2 Describe the necessity of air conditioning in building.
- 5.3 Name different elements of an air-conditioning unit suitable for use in all weather.
- 5.4 Mention different types of air conditioner.
- 5.5 Describe the suitable location of different air conditioners.
- 5.6 Explain the heat load and cooling load of a building.
- 5.7 List the factors that influence the summer and winter air conditioning.
- 5.8 Explain how to maintain conformable condition of efficient working.

**6. Understand the thermal insulation in building.**

- 6.1 Define thermal insulation.
- 6.2 Advantage of thermal insulation.
- 6.3 ~~Explain~~ Explain the heat transfer with basic definition.
- 6.4 Thermal insulation materials.
- 6.5 Effect of solar radiation in building.
- 6.6 Process of protecting building from solar radiation.
- 6.7 General methods of thermal insulation.
- 6.8 State the thermal insulation of followings:
  - (i) Roof
  - (ii) Exposed walls
  - (iii) Exposed doors.

**7. Understand the gas supply in building.**

- 7.1 Describe gas main.
- 7.2 Explain the connection procedure of service pipe with gas main.
- 7.3 List the tools required for gas supply.
- 7.4 Describe with sketch the gas meter.
- 7.5 Identify the fittings required for gas supply.
- 7.6 List different types of gas pipe and valve.
- 7.7 Distinguish between pipe lines supply and gas cylinder supply.
- 7.8 Explain the importance of bio-gas plant system in Bangladesh.
- 7.9 Describe the safety required for gas supply and consume.

**8. Understand Building lighting control works.**

- 8.1 What is the necessity of building lighting?
- 8.2 How to control the building's lighting.

- 8.3 Discuss the artificial lighting system.
- 8.4 Discuss the harmful aspects of inadequate lighting in the building.

**9. Understand the electric facilities in building.**

- 9.1 Mention the history and definition of electricity.
- 9.2 Write notes on the topics mentioned below:
  - (i) Load
  - (ii) Sanctioned or approved load
  - (iii) Connected load
  - (iv) Load demand
  - (v) Electric bill calculation.
- 9.3 Describe with proper solution the followings:
  - (i) Load shedding
  - (ii) Faults
    - a) Phase to phase
    - b) Phase to earth or ground
  - (iii) Over load or over current flow.
  - (iv) Uneven voltage supply.
- 9.4 Define uninterruptible electricity supply.
- 9.5 Describe the necessity of uninterruptible electricity supply.
- 9.6 Describe with importance and limitation the followings:
  - (i) IPS
  - (ii) Generator
- 9.7 Explain the power supply unit of the building.
- 9.8 Describe various types of electric safety and security system.
- 9.9 Explain the benefit of single point power/electricity control in emergency situation.

**10. Understand the solar electricity used in building.**

- 10.1 Define solar electricity.
- 10.2 List the materials required for solar system.
- 10.3 Mention the application of solar technology.
- 10.4 Specify solar electricity benefits compared to electricity supplied.
- 10.5 Specify the rules of solar power in Bangladesh's electricity system.
- 10.6 Describe the necessity of solar electricity system in Bangladesh.

**11. Understand the acoustics and sound insulation in building.**

- 11.1 Explain acoustics.
- 11.2 State the followings:
  - (i) Frequency of sound
  - (ii) Wave length of sound
  - (iii) Velocity of sound
  - (iv) Propagation of sound.
- 11.3 State sound absorption.
- 11.4 State the followings acoustical defects:
  - (i) Reflection
  - (ii) Reverberation
  - (iii) Formation of echoes
  - (iv) Focus point
  - (v) Dead spots
  - (vi) Loudness
  - (vii) Noise
- 11.5 General principles and factors in acoustical design.
- 11.6 Understand the acoustic design needs of various indoor environments

- 11.7 State sound insulation.
- 11.8 Describe the process of sound insulation.
- 11.9 Difference between sound absorption and sound insulation.

**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.

**13. Understand the building security system.**

- 13.1 Define building security.
- 13.2 List different types of building security system.
- 13.3 Explain the necessity of building security.
- 13.4 Describe the close circuit television as a security device.
- 13.5 Mention the uses of smart control door lock as a security device.
- 13.6 Explain how the alarming devices help to secure the house.
- 13.7 Explain the importance of smoke and fire detection system.
- 13.8 Explain single point of access for monitoring and control of building.

**14. Understand the communication system in building.**

- 14.1 Explain the importance of communication system in building.
- 14.2 State different types of communication system required in building.
- 14.3 Describe the necessity of emergency communications.
- 14.4 Describe the importance of the followings in building:
  - (i) CATV
  - (ii) CC TV
  - (iii) Telephone
  - (iv) Intercom.
- 14.5 Describe the importance of access control of building.

**15. Understand the parking system in building.**

- 15.1 Define parking garage.
- 15.2 Suitable place for parking garage.
- 15.3 Explain the necessity of parking garage in building.
- 15.4 Describe the following:
  - (i) Basement parking garage.
  - (ii) Underground parking garage.
  - (iii) Multi-storey parking garage.
- 15.5 Distinguish between Basement and Underground parking garage.
- 15.6 Parking control.

**16. Understand fire protection.**

- 16.1 State the meaning of fire protection.
- 16.2 Explain the terms fire resistance.
- 16.3 Fire resistance construction.
- 16.4 Explain the necessity of fire alarms in any building.
- 16.5 List the fire extinguishing equipments.

**17. Understand fire fighting and extinguishing.**

- 17.1 State the meaning of fire fighting and extinguishing.
- 17.2 Describe the measures to be taken when a building on fire.
- 17.3 Explain the security measures to be taken in a building to safe from fire.
- 17.4 Explain the necessity of safe fire exit in building.
- 17.5 List the fire fighting tools and requirement.
- 17.6 Describe the operation of fire fighting extinguisher.

### **PRACTICAL:**

1. Identify the pipes and fittings required to supply the gases.
2. Construct a Gas supply system according to the Design diagram.
3. Perform the installation procedure of solar electricity setting system.
4. Perform dual (hot & cool) water supply Design diagram in building
5. Identify the tools used in refrigeration and air conditioning works.
6. Identify the tools & materials used in thermal insulation works in building.
7. Identify different types of Building security system.
8. Identify, select and check appropriate fire fighting and safety equipment
9. Identify the problems in building acoustics and plan for solutions
10. Visit a modern building and observe all mechanism of the control system.

### **REFERENCE BOOKS**

1. Intelligent Buildings and Building Automation - Shengwei Wang
2. Understanding Building Automation Systems -Reinhold A. Carlson (Author),  
- Robert A. Di Giandomenico (Author)
3. Basic Electricity - Charles W. Ryan

**AIMS:**

After completion of the course students will able to:

- Understand the influence of the climatic condition of Bangladesh on its ground water and surface water flow;
- Compare various means of lifting underground water and to select appropriate means for given situation
- Select a suitable source of water and method or irrigation for particular situation;
- Understand the feature of Dam and Dyke;
- Select a suitable method for control of rivers and flood in Bangladesh.
- Understand rain water harvesting and recharging.

**SHORT DESCRIPTION**

Sources of water; Rainfall and run-off; Ground water and Lifting of ground water; Methods of irrigation; Storage reservoir; Irrigation canals; Reclamation of salt affected water logged land; Dam and Dyke, River training works; Flood and flood control, Rain water harvesting and recharging.

**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) Permeable and impermeable strata of soil.
  - h) Precipitation
  - i) 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 ground water.**

- 3.1 Define ground water.
- 3.2 Explain the zone of ground water.
- 3.3 Explain the ground water pollution process.
- 3.4 Explain the ground water pollution control and improvement.

**4. Understand the technique of lifting ground 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) Determining strainer size & length
  - b) Aquifer depth determination
  - c) Specific yield.
  - d) Influence area.
  - e) Lowering of Pipes and strainer
  - f) 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 condition.
- 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 different types of irrigation canals.**

- 10.1 State the meaning of main, branch, distributaries and field canal.
- 10.2 Mention the points to be considered in fixing the alignment of an irrigation canal.
- 10.3 Mention the factors to be considered for designing an irrigation canal.
- 10.4 Describe with sketches the distributaries system of irrigation canals.

**11. Understand the principles of reclamation of salt affected water logged Land.**

- 11.1 State the meaning of land reclamation.
- 11.2 Explain the necessity of land reclamation.
- 11.3 Mention the steps for reclamation of salt affected land.
- 11.4 State the meaning of water logging.
- 11.5 Mention the effects of water logging.

**12. Understand the causes of silt deposition.**

- 12.1 State the meaning of silt and silt ration.
- 12.2 Mention the causes of silt ration.
- 12.3 State the meaning of scouring.
- 12.4 Mention the causes of scouring.

**13. Understand the features of dam and dyke.**

- 13.1 State the meaning of dam and dyke.
- 13.2 Give classification of dam (rigid and non-rigid).
- 13.3 Differentiate between dam and dyke.
- 13.4 Mention the favorable conditions for location of a dam.
- 13.5 Mention the advantages and disadvantages of an earthen dam.
- 13.6 Describe drainage system under a dam.
- 13.7 Mention the term core wall and line of saturation with sketches.
- 13.8 Describe the construction procedure of earthen dam and dyke.
- 13.9 Mention the causes of failure of earthen dam and dyke.
- 13.10 Mention the remedies for preventing the failure of an earthen dam.
- 13.11 State the meaning of barrage, weir and spillway.

**14. Understand the necessity of river training works.**

- 14.1 State the meaning of river training & river training head works.
- 14.2 Name the different components of a head works.
- 14.2 Outline the object of river training.
- 14.3 Mention different methods of river training works.
- 14.4 Mention the functions of guide bank, groyne, spur, afflux, marginal bund and stone apron.
- 14.5 Explain the necessity of river training works in Bangladesh.

**15. Understand the concept of flood and flood control.**

- 15.1 State the meaning of flood.
- 15.2 Mention the causes of flood.
- 15.3 Mention different methods of controlling flood.
- 15.4 Specify the causes of flood in Bangladesh.
- 15.5 Describe the suitable method(s) for flood control in Bangladesh.
- 15.6 Understand the principles of construction, repair and maintenance works of different structures for irrigation and flood control.



**16. Understand the concept of rain water harvesting.**

- 16.1 State the meaning of rain water harvesting.
- 16.2 Mention the necessity of rain water harvesting.
- 16.3 Describe different methods of runoff collection.
- 16.4 Describe various type of detention basin.
- 16.5 Describe different methods of rain water harvesting.
- 16.6 Describe different methods of rain water recharging process.

**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. Prepare a model for a typical irrigation project.
5. Prepare a model for a typical drainage project.
6. Prepare a model for a typical flood control project.
7. Visit an irrigation project in Bangladesh and write a report.
8. Visit a drainage project in Bangladesh and write a report.
9. Visit a flood control project in Bangladesh and write a report.
10. 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 enable to apply the knowledge of scientific principles to problems of mechanical nature.
- To develop an understanding of mechanical properties of materials.
- To assist in applying mathematical and geometrical calculations to the analysis of statically determinate beams.

**SHORT DESCRIPTION**

Mechanical properties of material; Laws of forces; Moment; Friction; Centroid and centre of gravity; Moment of inertia; Torsion on circular shaft; Shear force and bending moment.

**DETAIL DESCRIPTION****Theory:****1.0 Understand the important aspects of mechanical properties of materials.**

- 1.1 Mention the necessity to know about the mechanical properties of materials.
- 1.2 Define the following terms:
  - a. Stress, tensile stress, compressive stress, shear stress.
  - b. Strain, tensile strain, compressive strain, shear strain,
  - c. Hooke's law, modulus of elasticity and modulus of rigidity.
- 1.3 Explain stress-strain diagram of mild steel and concrete.
- 1.4 Define the following terms:
  - a. Elasticity, proportional limit, yield point, ultimate stress, breaking stress, working stress and factor of safety.
  - b. Strength, stiffness, toughness, ductility, malleability, brittleness, creep, fatigue failure, resilience, modulus of resilience, thermal stress in simple bar and Poisson's ratio.
- 1.5 Compute stress, strain, modulus of elasticity and modulus of rigidity.
- 1.6 Solve problems involving resilience, thermal stress and Poisson's ratio.
- 1.7 Compute stress developed in composite bar under tension and compression.

**2. Understand the concept of laws of forces.**

- 2.1 Explain the laws of forces.
- 2.2 Define the following terms:

Force, co-planar forces, non-coplanar forces, concurrent forces, non-concurrent forces, co-linear forces, parallel forces, laws of equilibrium of forces.
- 2.3 Mention the parallelogram laws of forces.
- 2.4 State the composition of forces and resolution of force.
- 2.5 Define component of force, rectangular component and resultant of forces.
- 2.6 Compute the resultant force-
  - a. Triangle of forces
  - b. Polygon of forces
  - c. Converse laws of triangle and polygon laws of forces graphically.
- 2.7 Calculate the resultant of forces: co-planar forces, concurrent forces, parallel forces and co-linear forces
- 2.8 Explain Lami's theorem.
- 2.9 Solve problems on Lami's theorem.

**3. Understand the aspects of moment of forces.**

- 3.1 Define the term moment (analytically and graphically).
- 3.2 Differentiate moment with force.
- 3.3 Explain Varignon's principle of moment.
- 3.4 Distinguish like and unlike parallel forces.

- 3.5 State the meaning of couple.
- 3.6 Mention the properties of couple.
- 3.7 Solve problems on moment of couple and moment of forces.
- 3.8 Solve problems on moment of like and unlike parallel forces.

**4. Understand the concept of frictional forces.**

- 4.1 State friction, static friction and dynamic friction.
- 4.2 Mention the laws of static friction and dynamic friction.
- 4.3 Explain angle of friction and co-efficient of friction.
- 4.4 Compute friction of a body on horizontal planes.
- 4.5 Compute friction of a body on inclined planes.
- 4.6 Compute frictional force acting on a ladder.

**5. Understand the aspects of centroid and centre of gravity.**

- 5.1 Define the terms: centroid and centre of gravity.
- 5.2 State the axis of symmetry and parallel axis.
- 5.3 Compute the centroid by the method of moment of the following sections:
  - a. rectangular
  - b. triangular
  - c. circular
  - d. semi-circular
  - e. hollow
  - f. I-shaped
  - g. T-shaped
  - h. L-shaped
- 5.4 Solve problem on centre of gravity of a composite parallelepiped body.

**6. Understand the concept of moment of inertia.**

- 6.1 State 1st and 2nd moment of area.
- 6.2 Explain the meaning of radius of gyration.
- 6.3 Mention the theorems of moment of inertia.
- 6.4 Compute the moment of inertia of plane area about any axis of the following sections:
  - a. rectangular
  - b. triangular
  - c. circular
  - d. semi-circular
  - e. hollow
  - f. I-shaped
  - g. T-shaped
  - h. L-shaped

**7. Understand the aspects of torsion on solid and hollow circular shaft.**

- 7.1 State the laws of motions.
- 7.2 Explain the term circular motion.
- 7.3 Define the terms: torsion and torsional stress.
- 7.4 Mention the fundamental assumptions of torsional stress.
- 7.5 Find the relation between torsional stress and strain.
- 7.6 Interpret the formulas relating to finding torque
- 7.7 Solve problems involving torsion.

**8. Understand shear force (SF) and bending moment (BM).**

- 8.1 Define the term 'beam'.
- 8.2 List different types of beams.
- 8.3 Mention various types of load on beams.
- 8.4 Define shear force and bending moment.
- 8.5 Differentiate between shear force and bending moment.
- 8.6 Mention the sign conventions of shear force and bending moment.
- 8.7 List the characteristics of shear force and bending moment diagram.
- 8.8 Calculate and draw SF and BM diagram of cantilever beams with point load, distributed load and both.
- 8.9 Calculate and draw SF and BM diagram of simply supported beams with point load, distributed load and both.
- 8.10 Calculate and draw SF and BM diagram of simply supported overhanging beam with point load, distributed load and both.

**PRACTICAL:**

1. Perform compression test of a timber specimen.
2. Conduct tensile test of mild steel rod and draw stress-strain curve with test results.

3. Determine the percentage elongation of mild steel.
4. Determine the centroid of a composite area.
5. Determine the resultant of a force system graphically.
6. Show the resultant of forces by using force board.
7. Prove the Lami's theorem by using force board.
8. Practice to determine the co-efficient of friction of timber, concrete and mild steel.
9. Practice to determine reactions of a beam by using spring balance.

**REFERENCE BOOKS:**

1. Structural Mechanics - W Morgan and D T Williams
2. Structural Mechanics - Singer / Popov
3. Mechanics of Materials - Philip Gustave Laurson and Williams Junkin Cox
4. Structural Mechanics - A. K. Upadhyay Published by SK Kateria & Sons, India.
5. Applied Mechanics - R.S Khurmi

**AIMS:**

At the end of the course the student will be able:

- To understand of the origin, composition, classification and properties of soil.
- To assist in understanding the plasticity characteristics and hydraulic properties of soil.
- To assist in understanding the consolidation characteristics of soil.
- To assist in understanding the lateral earth pressure of soil.
- To provide understanding of the site investigation and method of sample collection.
- To provide basic field skill for collection of soil sample.
- To provide basic laboratory skill required to determine soil properties and to perform the relevant calculations.

**SHORT DESCRIPTION:**

Introduction to geotechnical engineering; Preliminary definition and simple tests; Particle size of soil; Plasticity characteristic of soil; Hydraulic properties of soil; Consolidation characteristics of soil; Subsurface investigation; Lateral earth pressure; Bearing capacity of soil.

**DETAIL DESCRIPTION:****Theory:****1. Understand the basic concept of geotechnical engineering.**

- 1.1 Define rock, soil and soil engineering.
- 1.2 Describe origin and formation of soil.
- 1.3 Describe major soil deposits in Bangladesh.
- 1.4 Explain limitation of soil engineering.
- 1.5 Mention the soil classification system.
- 1.6 State textural, AASHO and unified ASTM system.
- 1.7 State field identification test such as; dilatancy, toughness, dry strength test & shaking test.
- 1.8 List general properties of soil.

**2. Understand preliminary soil tests.**

- 2.1 Define the following terms: void ratio, porosity, degree of saturation, percentage of air voids, air content, water content, bulk unit weight, dry unit weight, saturated unit weight, submerged unit weight, unit weight of solids, specific gravity of solids, density index.
- 2.2 Explain three-phase diagram in terms of void ratio.
- 2.3 Explain three-phase diagram in terms of porosity.
- 2.4 Solve problems on soil properties.
- 2.5 Explain oven drying method of water content determination.
- 2.6 Explain specific gravity determination by pycnometer method.

**3. Understand the particle size of soil.**

- 3.1 Define index properties of soil.
- 3.2 State mechanical analysis of soil.
- 3.3 Describe sieve analysis.
- 3.4 Mention and interpret stokes law.
- 3.5 Describe particles size analysis by hydrometer.

**4. Understand the plasticity characteristics of soil.**

- 4.1 Define: plasticity of soil, Atterberg limit, liquid limit, plastic limit, shrinkage limit,
- 4.2 Explain plasticity index, liquidity index, consistency index, flow index and toughness index.
- 4.3 State the method of measurement of consistency.
- 4.4 Define the terms: sensitivity and thixotropy.

4.5 List the uses of consistency (Atterberg) limits.

**5. Understand the hydraulic properties of soil.**

- 5.1 Define the following: Permeability of soil, hydraulic head, piezometric head, position head.
- 5.2 State & Explain Darcy's law.
- 5.3 State the constant head and variable head permeability test for determination of co-efficient of permeability.
- 5.4 Describe the pumping out tests for determination of coefficient of permeability.
- 5.5 Compute effective pressure and pore water pressure.
- 5.6 List the factors affecting permeability of soil.
- 5.7 Define seepage pressure, seepage velocity, equipotential line and flow net.

**6. Understand the consolidation characteristics of soil.**

- 6.1 Define consolidation
- 6.2 Classify & explain consolidation.
- 6.3 State behavior of saturated soil under pressure.
- 6.4 Identify triaxial compression test apparatus.
- 6.5 Differentiate between consolidation and compaction of soil.
- 6.6 State standard proctor test of compaction.
- 6.7 Explain optimum moisture content & percent compaction.
- 6.8 State unconfined test.
- 6.9 State confined compression test.

**7. Understand the purpose of subsurface investigation.**

- 7.1 State subsurface investigation of soil.
- 7.2 Mention the stages in subsurface explorations.
- 7.3 Mention the purposes of subsurface investigation of soil.
- 7.4 Compute the depth and lateral extent of explorations.
- 7.5 Describe the open excavation (Test Pit) methods of explorations.
- 7.6 Describe auger boring, wash boring, and rotary drilling.
- 7.7 Identify various types of soil samples.
- 7.8 Identify split barrel sampler, spring core catches, scraper bucket and piston sampler for collecting samples.
- 7.9 Describe the method of standard penetration test (SPT).
- 7.10 State the procedure of writing subsoil investigation report.

**8. Understand the aspect of lateral earth pressure.**

- 8.1 State the meaning of at-rest pressure, active earth pressure and passive earth pressure.
- 8.2 explain active and passive earth pressure of Rankine's theory with non-surcharge.
- 8.3 State the formula of active earth pressure of Rankine's theory with surcharge.
- 8.4 State the fundamental assumptions of Coulomb's wedge theory.
- 8.5 State the formula of active earth pressure of Coulomb's theory with surcharge.

**9. Understand the bearing capacity of soil.**

- 9.1 Define bearing capacity of soil.
- 9.2 Correlate between penetration resistance and unconfined compressive strength for cohesive soil.
- 9.3 Correlate between penetration resistance and angle of shearing resistance for cohesion less soil.
- 9.4 Explain the bearing capacity from Standard Penetration Test (SPT).
- 9.5 List the causes of foundation settlement.

**PRACTICAL:**

1. Determine the water content of soil by oven drying method.
2. Determine the specific gravity of soil by pycnometer method.
3. Determine bulk unit weight & dry unit weight of soil.
4. Determine the particle size of soil by sieve analysis.

5. Determine the particle size of soil by hydrometer analysis.
6. Determine the liquid limit of soil by casagrand's apparatus.
7. Determine the plastic limit of soil.
8. Determine the co-efficient of permeability of soil by constant head test.
9. Determine the shear strength of soil using vane shear test.
10. Determine the bearing capacity of soil from Standard Penetration Test (SPT).
11. Determine the amount of compaction and the water content by standard proctor test.
12. Determine the shear characteristics of soil by unconfined compression test.

**REFERENCE BOOKS:**

- 1 Foundation Engineering - Ralph B Peck, Walter, E Hanson
- 2 Soil Mechanics and Foundation Engineering - Dr. K. R.Arora.
3. Soil Mechanics and Foundation - Dr. B. C.Punmia.
- 4 Foundation Analysis and Design - Josef and Vawels.

**AIMS:**

- To be able to understand the basic concepts and principles of business organization.
- To be able to understand the banking system.
- To be able to understand the trade system of Bangladesh.
- To be able to understand the basic concepts of communication and its types, methods.
- To be able to perform in writing, application for job, complain letter & tender notice.

**SHORT DESCRIPTION:**

Principles and objects of business organization; Formation of business organization; Banking system and its operation; Negotiable instrument; Home trade and foreign trade. Basic concepts of communication Communication model & feedback; Types of communication; Methods of communication; Formal & informal communication; Essentials of communication; Report writing; Office management; Communication through correspondence; Official and semi- official letters.

**DETAIL DESCRIPTION:****Theory:****1 Concept of Business organization.**

- 1.1 Define business.
- 1.2 Mention the objects of business.
- 1.3 Define business organization.
- 1.4 State the function of business organization.

**2 Formation of Business organization.**

- 2.1 Define sole proprietorship, partnership, Joint Stock Company. and co-operative
- 2.2 Describe the formation of sole proprietorship, partnership, joint stock Company, & co operative.
- 2.3 Mention the advantages and disadvantages of proprietorship, partnership and Joint Stock Company.
- 2.4 State the principles of Co operative & various types of Co operative.
- 2.5 Discuss the role of co-operative society in Bangladesh.

**3 Basic idea of Banking system and negotiable instrument.**

- 3.1 Define bank.
- 3.2 State the service rendered by bank.
- 3.3 Describe the classification of bank in Bangladesh.
- 3.4 State the functions of Bangladesh Bank in controlling money market.
- 3.5 State the functions of commercial Bank in Bangladesh
- 3.6 Mention different types of account operated in a bank.
- 3.7 Mention how different types of bank accounts are opened and operated.
- 3.8 Define negotiable instrument.
- 3.9 Discuss various types of negotiable instrument.
- 3.10 Describe different types of cheque.



#### **4 Home & foreign trade**

- 4.1 Define home trade.
- 4.2 Describe types of home trade.
- 4.3 Define foreign trade.
- 4.4 Mention the advantages and disadvantages of foreign trade.
- 4.5 Discuss the import procedure & exporting procedure.
- 4.6 Define letter of credit.
- 4.7 Discuss the importance of foreign trade in the economy of Bangladesh.

#### **5 Basic concepts of communication**

- 5.1 Define communication & business communication.
- 5.2 State the objectives of business communication.
- 5.3 Describe the scope of business communication.
- 5.4 Discuss the essential elements of communication process.

#### **6 Communication model and feedback.**

- 6.1 Define communication model.
- 6.2 State the business functions of communication model.
- 6.3 Define feedback.
- 6.4 State the basic principles of effective feedback.

#### **7 Types and Methods of communication.**

- 7.1 Explain the different types of communication;-
  - a) Two-way communication
  - b) Formal & informal communication
  - c) Oral & written communication
  - d) Horizontal & vertical communication
  - e) external & internal communication
  - f) Spoken & listening communication.
- 7.2 Define communication method.
- 7.3 Discuss the various methods of communication.
- 7.4 Distinguish between oral and written communication.

#### **8 Essentials of communication.**

- 8.1 Discuss the essential feature of good communication.
- 8.2 Describe the barriers of communication.
- 8.3 Discuss the means for overcoming barriers to good communication.

#### **9 Report writing.**

- 9.1 Define report, business report & technical report.
- 9.2 State the essential qualities of a good report.
- 9.3 Describe the factors to be considered while drafting a report.
- 9.4 Explain the components of a technical report.
- 9.5 Prepare & present a technical report.

#### **10 Office management.**

- 10.1 Define office and office work.
- 10.2 State the characteristics of office work.
- 10.3 Define filing and indexing.
- 10.4 Discuss the methods of filing.

- 10.5 Discuss the methods of indexing.
- 10.6 Distinguish between filing and indexing.

#### **11 Official and semi-official letters.**

- 11.1 State the types of correspondence.
- 11.2 State the different parts of a commercial letter.
- 11.3 Define official letter and semi-official letter.
- 11.4 Prepare & present the following letters: Interview letter, appointment letter, joining letter and application for recruitment. Complain letters, tender notice.

#### **REFERENCE BOOK:**

1. উচ্চ মাধ্যমিক ব্যবসায়নীতি ও প্রয়োগ -মোহাম্মদ খালেকুজ্জামান
2. উচ্চ মাধ্যমিক ব্যাংকিং ও বীমা -প্রফেসর কাজী নুরুল ইসলাম ফারুকী
3. আধুনিক কারবার পদ্ধতি -লতিফুর রহমান
4. কারবার যোগাযোগ ও সচিবের কার্যপদ্ধতি -প্রফেসর লতিফুর রহমান ও প্রফেসর কাজী নুরুল ইসলাম ফারুকী
5. ব্যবসায়িক যোগাযোগ এবং অফিসের কর্মপ্রণালী -ড. এম, এ, মান্নান
6. ব্যবসায় যোগাযোগ – মোহাম্মদ খালেকুজ্জামান ও মোঃ মুশাররফ হোসেন চৌধুরী
7. Business organization & management- M.C. Shukla
8. Business organization & management- R.N. Gupta