Civil Technology (64)

SYLLABUS
(COURSE STRUCTURE-2010)

SIXTH SEMESTER
AIMS

- To be able to understand field astronomy.
- To be able to determine latitude and longitude of a place.
- To be able to present a production map.
- To be able to learn using digital theodolite, total station, global positioning system (GPS), Geographic Information Systems (GIS).
- To be able to conduct project surveying.
- To be able to understand mine surveying.

SHORT DESCRIPTION

Field astronomy; Digital theodolite; Total station; Global positioning system (GPS); Geographic Information Systems (GIS), Project surveying; Mine surveying.

DETAIL DESCRIPTION

Theory:

1. Understand field astronomy.
   1.1 State the astronomical terms: Spherical trigonometry, Small circle, Great circle, Celestial sphere, Zenith, Nadir, Celestial horizon, Visible horizon, Polar equator, Polar axis, Celestial equator, Celestial poles.
   1.2 Determine the length of a great circle arc.
   1.3 Determine the length of a small circle arc.
   1.4 Mention the properties of a spherical triangle.

2. Understand method of locating the position of heavenly body (sun or star).
   2.1 State the altitude and azimuth system.
   2.2 State the declination and hour angle system.
   2.3 State the declination and right ascension.

3. Understand different types of time.
   3.1 State the terms: Sederal time, Apparent solar time, Mean solar time, Local time, Local mean time, Green witch mean time and Standard time.
   3.2 Describe the equation of time.
   3.3 Convert standard time to local mean time and vice versa.
   3.4 Convert local time to green witch mean time and vice versa.

4. Understand Polaris, meridian and azimuth.
   4.1 Define the terms: Polaris, Meridian and Azimuth.
   4.2 Describe the procedure of determination of true meridian of a place by observing polaris at culmination and elongation.
   4.3 Determine the azimuth of a survey line by observation of heavenly body (sun or star).

5. Understand latitude and longitude.
   5.1 State the latitude of a place.
   5.2 Describe the procedure of locating the position of latitude of a place by observation of Polaris only.
   5.3 State the longitude of a place.
   5.4 Describe the procedure of locating the position of latitude of a place by triangulation, chronometer, wireless time, signals.
   5.5 Calculate the difference of latitude and longitude of two places and measure the distance between them.
5.6 Explain the purposes and uses of solar attachment.
5.7 Describe the procedure of determining the direction of meridian and local time.

7 Understand the baseline.
  7.1 Define base line.
  7.2 List the instruments required for base line measurement.
  7.3 List the equipment required for base line measurement.
  7.4 Explain the terms: Check base, Base net and Extension of base.
  7.5 Explain the necessity of measuring base line.
  7.6 List the necessary corrections in the field measurement of a base line.
  7.7 Explain the corrections in the field measurement of a base line.
  7.8 List the steps of fieldwork in measuring a base line.
  7.9 Explain normal tension.
  7.10 Describe the procedure to measure a base line.
  7.11 Solve problems on base line measurement.

8 Understand the digital theodolite.
  8.1 Define digital theodolite.
  8.2 Compare digital theodolite with others.
  8.3 Describe the components of digital theodolite and its function.
  8.4 Explain the term: Display panel and angle measuring mode.
  8.5 Describe the procedure of setting digital theodolite.
  8.6 Describe the procedure of taking horizontal angle with digital theodolite.
  8.7 Describe the procedure of taking vertical angle with digital theodolite.
  8.8 Explain the procedure of measuring magnetic bearing of a line.

9 Understand the principle of operation and uses of total station.
  9.1 Explain the function of the total station.
  9.2 State focusing and target point of total station.
  9.3 Describe the procedural steps of setting total station.
  9.4 Mention the precaution for using total station.
  9.5 Mention the procedure centering and leveling.

10. Understand the operation panel.
  10.1 Describe the basic key operation.
  10.2 Describe soft key operation.
  10.3 Define inputting letters and figures.
  10.4 Mention the function of allocation key.
  10.5 State the allocation key function.
  10.6 Explain configuration mode, measurement mode and memory mode.
  10.7 Describe the process of selecting different options.

11 Understand the principle of adjustment of total station & the principle of measuring horizontal angle.
  11.1 List the principle types of adjustment.
  11.2 State the check and adjustment of total station.
  11.3 Mention the techniques of check and adjustment of total station.
  11.4 Define horizontal angle.
  11.5 Define horizontal and vertical circle indexing.
  11.6 State the meaning of horizontal angle hold.
  11.7 Explain horizontal angle repetition.
  11.8 Explain the procedure of horizontal angle between two points with total station.

12 Understand distance and co-ordinates measurement with total station.
  12.1 Describe the procedure of EDM setting in the total station.
  12.2 Describe the procedure of measuring horizontal distance and slop
12.3. Describe the procedure of measuring vertical distance with total station.
13.4. Explain 3-D co-ordinates.
13.5. State the procedure of entering instrument station data.
13.6. Mention the procedure of azimuth angel setting.
13.7. Describe the procedure of 3-D co-ordinates measurement.

13. Understand resection measurement and setting out measurement.
13.1. Explain co-ordinates resection measurement.
13.2. Describe height resection measurement.
13.3. Explain distance setting out measurement.
13.4. Explain co-ordinates setting out measurement.
13.5. Describe remote elevation measurement (REM) and setting out measurement.

14. Understand the setting outline and point projection.
14.1. Define base line.
14.2. Explain setting out line point.
14.3. Explain setting out line.
14.4. Explain point projection.

15. Understand the offset measurement and missing line measurement.
15.1. State single distance offset measurement
15.2. Define angle offset measurement.
15.3. Explain two distances offset measurement.
15.4. Explain the measurement of the distance between two or more point.
15.5. Describe the procedure of changing the starting point.

16. Understand the data recording.
16.1. Define reading instrument station data.
16.2. Define angle measurement data.
16.3. State recording distance measurement data.
16.4. Explain recording co-ordinate data.
16.5. Describe recording distance and co-ordinate data.
16.6. Describe the process of reviewing the job data.

17. Understand the data memory mode.
17.1. Explain selecting/deleting an data.
17.2. State registering/deleting known point data.
17.3. Explain reviewing known point data.
17.4. State registering/deleting codes.
17.5. Describe reviewing of codes.
17.6. Describe outputting job data.

18. Understand the change of setting.
18.1. Define changing instrument option.
18.2. Explain allocating key function.
18.3. State restoring default settings.

19. Understand the principles of operation and uses of GPS receiver.
19.1. Explain the meaning of global positioning system (GPS).
19.2. Describe the working principles of GPS receiver.
19.3. Mention different features of GPS receiver.
19.4. Describe operational process of the instruments related to GPS.
19.5. Describe the specifications of available brand of GPS receiver.
19.6. Describe the procedure of finding co-ordinates (latitude & longitude) of a station using GPS receiver.
19.7. List the required accessories related to GPS.
19.8. List the works performed by GPS receiver.
19.9. Explain software used in GPS receiver.
19.10 Mention different types of software used in GPS receiver.
19.11 Mention the applications of different softwares.
19.12 Describe the preparation of a map using mapping software and data received with GPS receiver.

20. Understand the principle of Geographic Information Systems (GIS)
20.1 Definition of GIS.
20.2 Development history of GIS.
20.3 Benefits of GIS.
20.4 Major application of GIS.
20.5 GIS and other sciences.
20.6 Basic functions of GIS.
20.7 GIS and organization.
20.8 GIS data model.
20.9 Topology in GIS.
20.10 Source of geographic data.
20.11 Methods of data capture.
20.12 Meta data.

21. Spatial Database and Computer System for GIS
21.1 Required function for Spatial Database.
21.2 Distribution of Spatial Database.
21.3 Database management system.
21.4 Required hardware and software.
21.5 Types of GIS software.
21.6 GIS installation.
21.7 Output of GIS product.

22 Understand the concept of project surveying.
22.1 Define project surveying.
22.2 Explain the necessity of project surveying.
22.3 List the instrument required for a project survey.
22.4 Name different engineering projects.
22.5 Mention the steps of project surveying.
22.6 Describe the different types of project such as: Irrigation, Hydrographic, Sewer line and tunnel survey

23 Understand the concept of mine surveying.
23.1 Define mine surveying.
23.2 Explain the purpose of mine surveying.
23.3 Mention the difficulties in mine surveying.
23.4 Explain the following terms:
   a. Station and station markers
   b. Illumination
   c. Surface survey
   d. Bearing of a drift
23.5 List the equipment and instruments required for mine surveying.
23.6 Explain the use of mining transit.
23.7 Explain the following terms:
   a. Auxiliary telescope
   b. Tunnel survey
   c. Surface survey
   d. Sight pole
   e. Suspension mining compass
23.8 Describe the components of Brunton pocket transit and their function.

24 Understand the method of mine surveying.
24.1 Explain the procedure of measuring horizontal and vertical angle with compass.
24.2 Describe the procedure of transferring the surface line into underground.
24.3 Describe the procedure of measuring difference in elevation down a vertical shaft.
24.4 Compute bearing of a drift.
24.5 Describe the procedure of setting the center line down from the vertical shaft.

**Practical:**
1. Determine the height and distance of a tower using digital theodolite.
2. Conduct traversing with a digital theodolite and plot maps including computation of area.
3. Perform temporary and permanent adjustment of total station.
4. Determine height and distance of tower using total station.
5. Determine the width of Road/ River/Pond with total station.
6. Determine the co-ordinates and output the data.
7. Enter 3-D co-ordinates and output the data.
8. Conduct traversing with a total station and plot maps including computation of areas.
9. Measure the latitude and longitude of your position using GPS.
10. Observe your speed, distance and time to reach your destination and find the latitude and longitude of the place.
11. Determine the co-ordinates of a station (within the institute) using GPS receiver.
12. Installing GIS software, Data input and managing.
15. Prepare Database.
16. Cartographic Database.
REFERENCE BOOKS
1. Surveying & Leveling (Part-II) - T. P. Kanetker
2. Advance Surveying - Natarajan
3. Surveying (Volume-2) - Dr. B.C. Punmia
5. Surveying Theory and Practice - E.Davis & S. Foote
6. A Text Book of surveying (Volume-II) - P.B. Shahani
AIMS

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

SHORT DESCRIPTION

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

DETAIL DESCRIPTION

Theory:

1 Understand the modes of transportation and history of road development.

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

2 Understand the concept of highway planning.

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

3 Understand the concept of alignment of road and survey.

3.1 Define alignment of road.
3.2 Mention the fundamental principles of alignment of road.
3.3 Mention the factors that controls the selection of alignment of road.
3.4 Describe the reconnaissance survey for a road construction.
3.5 Describe the preliminary survey, final location survey and soil survey for a road construction.
3.6 Mention the points to be considered in fixing location of a new urban road.

4 Understand the principles of highway geometric.

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

5 Understand the concept of highway cross-section.

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

6 Understand the concept of sight distance.

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

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

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

8 Understand the concept of highway intersections.

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

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

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

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

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

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

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

12 Understand the construction of low cost road.

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

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

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

14 Understand the construction of Bituminous road.

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

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

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

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

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

19 Understand the concept of road arboriculture.
19.1 State the meaning of arboriculture.
19.2 Explain the purpose of plantation on road sides.
19.3 Describe the process of tree planting, pattern of tree planting and protection of trees on road sides.
19.4 Mention the advantages and disadvantages of trees on road sides.

20 Understand the machineries used for construction of roads & highways.
20.1 List the machineries used for cleaning the site, earth cutting, earth removing, consolidating and grading in highway construction.
20.2 List the machineries used for crushing road metals.
20.3 List the machineries used for construction of bituminous road.
20.4 List the machineries used for construction of CC & RCC road.

21 Understand the causes of failures of roads & highways.

21.1 Describe the sub-grade, base and wearing course failures.
21.2 Mention the typical failures of flexible pavement.
21.3 Mention the causes of failures of CC & RCC road.
21.4 Mention the typical failures of CC & RCC road.

22 Understand the maintenance of highway.

22.1 Explain the significance of routine maintenance of highways.
22.2 Classify the maintenance work of road.
22.3 Describe the maintenance of
   (a) Earthen road.
   (b) Water bound macadam road.
   (c) Bituminous road.
   (d) CC & RCC road.
22.4 Mention the causes for corrugations and wavy surfaces.
22.5 Mention the remedies for corrugations and wavy surfaces.

23 Understand the highway bridges & culverts.

23.1 Distinguish between bridge and culvert.
23.2 Mention the ideal site for construction a bridge or culvert in roads & highways.
23.3 Classify the different types of bridges and culverts.
23.4 Mention the factors which effects the choice & type of bridge or culvert.
23.5 Define the terms: flood discharge, waterway, scouring depth, free board in the construction of bridges & culverts.
23.6 Explain the necessity of repair and maintenance of bridges & culverts.

24 Understand the concept of planning of airport.

24.1 Mention the information required for planning of an airport.
24.2 Mention the points to be considered in selecting the site for an airport.
24.3 Describe the terms: landing strip, approach zone, running lengths & hanger.
24.4 Classify different types of airport.

25 Understand the standard of geometrics used in airport.

25.1 Explain the terms: runway, taxiway, aprons, runway orientation, pattern & grade.
25.2 Distinguish between runway and taxiway.
25.3 State the meaning of heliport.
25.4 Mention the functions of terminal building.
25.5 Distinguish between heliport and airport.

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

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

**REFERENCE BOOKS**
1. Highway Engineering - by Gur Charan Singh
2. A text book on Highway Engineering and Airports - by S B Sehgal & K L Bhanot
3. Highway Engineering - by S C Rangwala
4. Highway and Airport Engineering - by V B Priyani
AIMS

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

SHORT DESCRIPTION

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

DETAIL DESCRIPTION

Theory:
1 Understand the different type of cement concrete works.
   1.1 Describe the plain concrete, reinforced concrete and prestressed concrete.
   1.2 Describe the different uses of the plain concrete, reinforced concrete and prestressed concrete.
   1.3 Mention the advantages, disadvantages & limitations of the plain concrete.
   1.4 Mention the advantages, disadvantages & limitations of the reinforced concrete.
   1.5 Mention the advantages, disadvantages & limitations of the prestressed concrete.

2 Understand the structural safety, design code and safety provision.
   2.1 Explain the need for structural safety.
   2.2 Solve simple problems using the design codes.
   2.3 Explain the necessity for safety provision.

3 Understand about the loads in designing reinforced concrete works.
   3.1 Define the meaning of load.
   3.2 Classify different kinds of loads.
   3.3 Define Richter scale, tectonic plate and epicenter.
   3.4 Explain the necessity of considering the seismic load and wind load in designing reinforced concrete works.
   3.5 Mention the significant of the thrust (like tidal, cyclones etc.) to be consider in designing reinforced concrete structure in coastal zone.

4 Understand stress, strain and elasticity of concrete.
   4.1 State the meaning of stress, strain, ultimate stress and allowable stress of concrete.
   4.2 Define young modulus of elasticity of concrete.
   4.3 Calculate young modulus of elasticity of concrete.
   4.4 Interpret stress-strain curve of steel and concrete.
   4.5 Mention the purpose of compression test of concrete.
4.6 State the different size & shape of moulds for compression test.
4.7 Describe test procedure of crushing cubes and cylinders for compression test.
4.8 Determine ultimate stress of concrete (f'c) and allowable stress of concrete (fc).
4.9 Determine the allowable shear stress of concrete using ultimate stress of concrete.

5 Understand the properties & behavior of reinforcing steel used in RCC.
5.1 List the different types & grades of steel used in RCC and prestressed concrete.
5.2 Mention the advantages of uses of mild steel in RCC.
5.3 Describe the scope of using welded wire fabric in RCC.
5.4 Mention the characteristics of plain bar, deformed bar and twisted bar and tendon.
5.5 Mention the advantages of uses of deformed and twisted bar in RCC.
5.6 State the minimum reinforcement used in RCC beam and slab.

6 Understand the flexure formula of homogeneous beam.
6.1 Define resisting moment.
6.2 Explain the stress diagram of a loaded beam.
6.3 Identify compression and tension zones of a homogenous beam.
6.4 Express the derivation of the flexure formula for homogeneous beam.
6.5 Solve the problems on homogeneous rectangular beam.

7 Understand the concept of transformed section of beam.
7.1 Define transformed section.
7.2 Explain the theory of transformed section with sketches.
7.3 Express the derivation of the equation for investigating the stresses developed in concrete and steel by transformed section method.
7.4 Calculate the stresses developed in rectangular beam and T-beam in WSD method.
7.5 Explain balanced reinforced beam, under reinforced beam and over reinforced beam.
7.6 Mention the effect of under reinforcement and over reinforcement in RCC beams.

8 Understand the flexure formula for RCC beam in working stress design (WSD) method.
8.1 State the assumptions used in developing the flexure formula.
8.2 Explain the stress diagram of a loaded RCC beam.
8.3 Mention the notations used in flexure formula in WSD method.
8.4 Express the derivation of the flexure formula for RCC beam in WSD method.
8.5 Solve problems of flexure formula based on WSD method.

9 Understand the shear stress developed in RCC beams.
9.1 Explain the effects of shear force and stress in RCC beams.
9.2 State the meaning of diagonal tension.
9.3 Explain the causes of creating diagonal tension in RCC beams.
9.4 Express the derivation of the formula to determine shear stress developed in RCC beams.
9.5 Solve the problems on shear stress developed in WSD method.
9.6 Solve the problems on shear stress developed in USD method.
9.7 Mention the allowable shear stress for RCC beam (v) and shear stress for concrete (v<sub>c</sub>).

10 Understand the functions of web reinforcement in RCC beams.
10.1 Define web reinforcement.
10.2 Classify web reinforcement with sketches.
10.3 Mention the functions of web reinforcement in RCC beams.
10.4 Determine the spacing of web reinforcement (vertical & inclined) in WSD method.
10.5 Determine the spacing of web reinforcement in USD method.
10.6 Determine the portion of the RCC beam requiring web reinforcement.

11 **Understand the bond stress developed in RCC beams.**
11.1 State the meaning of bond stress.
11.2 Express the derivation of the formula to determine bond stress developed in RCC beams.
11.3 State the allowable bond stress for plain bar and deformed bar in WSD and USD methods.
11.4 Determine the anchorage length of reinforcement in RCC.
11.5 Explain the necessity of standard hooks of reinforcement in RCC.

12 **Understand the design of RCC rectangular beam in WSD method.**
12.1 Outline the design steps of RCC rectangular beam in WSD method.
12.2 State the minimum spacing of reinforcing bars in RCC beam.
12.3 Design a simply supported RCC rectangular beam in WSD method.
12.4 Design a semi-continuous RCC rectangular beam in WSD method.
12.5 Design a continuous RCC rectangular beam in WSD method.

13 **Understand flexure formula in ultimate strength design (USD) method.**
13.1 Differentiate WSD and USD method.
13.2 Explain the stress diagram of loaded beam with showing the actual & equivalent rectangular stress distribution of ultimate load.
13.3 State the load and load factors used in USD method.
13.4 Mention the notations used in flexure formula in USD method.
13.5 Express the derivation of the flexure formula in USD method.
13.6 Solve problems of flexure formula based on USD method.

14 **Understand the design of RCC rectangular beam in USD method.**
14.1 Outline the design steps of RCC rectangular beam in USD method.
14.2 Design a simply supported RCC rectangular beam in USD method.
14.3 Design a semi-continuous RCC rectangular beam in USD method.
14.4 Design a continuous RCC rectangular beam in USD method.

15 **Understand the design of RCC cantilever & overhanging rectangular beams in WSD method.**
15.1 Determine the design load, shear force and bending moment of RCC cantilever & overhanging beams.
15.2 Design a cantilever RCC rectangular beam.
15.3 Design an overhanging RCC rectangular beam.
15.4 Describe the technique of curtailment of reinforcement in cantilever RCC beams.

16 **Understand the T-beam and its uses.**
16.1 Define T-beam.
16.2 Identify the different parts of a typical T-beam.
16.3 Determine the width of flange of T-beam considering span length and slab thickness.
16.4 State the ratio of width of web to the depth of web for T-beams.
16.5 Distinguish between RCC rectangular beam and T-beam.

17 **Understand the design of RCC T-beams.**
17.1 Determine the depth and width of a simply supported T-beam in respect to shear force.
17.2 Outline the design steps of RCC T-beam in WSD method.
17.3 Design a simply supported RCC T-beam in WSD method.
17.4 Design a semi-continuous RCC T-beam in WSD method.
17.5 Design a continuous RCC T-beam in WSD method.

18 **Understand the design of RCC beam with compression reinforcement.**
18.1 State the meaning of double reinforced beam.
18.2 Differentiate between RCC single and double reinforced beam.
18.3 Outline the design steps of double reinforced beam.
18.4 Design a simply supported double reinforced beam.
18.5 Design a semi-continuous double reinforced beam.
18.6 Design a continuous double reinforced beam.

19 Understand the design of RCC lintel over doors & windows.
19.1 Determine the area of the wall to be considered in determining the design load for RCC lintels.
19.2 Outline the design steps of RCC lintel.
19.3 Design a RCC lintel over doors and windows.

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

REFERENCE BOOKS
1. Simplified Design of Reinforced Concrete - by H Parker
2. Design of Concrete Structures - by G Winter, L C Urquhart, C E O’Rourke, A H Nilson
3. Treasure of R C C Designs - by Sushil Kumar
4. R C C Design - by Abul Faraz Khan
AIMS
• To be able to prepare production drawing of a multi-storied building.
• To be able to prepare detail drawing of building components.
• To be able to acquire knowledge and skill to prepare detail working drawing of a scheme.
• To be able to interpret the structural drawings of a multi-storied building.
• To be able to prepare production drawing of multi-storied building adopting CAD.

SHORT DESCRIPTION
2D & 3D CAD commands, Multi-storied building: Multi-storied building (CAD); Detail working drawing (CAD) of RCC column with footing; Lintel with sunshade; Retaining wall; Foundation; Beam; Slab; Stair case, ramp and lift core; Underground water reservoir; Septic tank; Bridge and culvert;

DETAIL DESCRIPTION

Theory:
1 Understand the functions and uses of different CAD commands.
1.1 State the meaning of WCS icon and UCS icon.
1.2 Mention the classifications of co-ordinate system.
1.3 State the necessity of drawing units and limits.
1.4 Mention the functions of the following editing commands: copy, move, array, offset, trim, fillet, chamfer, extend, break, rotate, stretch, mirror, change, chprop, scale and pedit.
1.5 Mention the functions of the following object grouping commands: block, insert, explode, wblock, divide, measure, purge, xref etc.
1.6 Mention the functions of the following enquiry commands: dist, area, ld, list etc.
1.7 Mention the functions of the following plotting commands: layout, view port, model space, paper space.
1.8 Mention the functions of the following dimension commands: dimension style, Ddim, leader, linear dimension, radius & diameter dimension, aligned dimension, continue dimension, base dimension etc.
1.9 Mention the functions of the following geometric commands: donut, solid, trace, pline, xline, ray, fill etc.
1.10 State the necessity of hatch and text.
1.11 State the functions of Auto CAD design center (ADC).

2 Understand the features of multi-storied building.
2.1 Define multi-storied building.
2.2 Mention the advantages of multi-storied building.
2.3 Mention the disadvantages of multi-storied building.
2.4 Describe the main features of a multi-storied building.
2.5 Describe the process of drawing of a multi-storied building.
2.6 List the drawings of a multi-storied building necessary for approval of the relevant authorities.

3 Understand the preparation of plan, section, elevation and other components of multi-storied framed structure building using CAD.
3.1 Describe the process of drawing the site plan and layout plan of a multistoried framed structure building.
3.2 Describe the process of drawing the plan, elevation and sectional
3.3 Describe the process of making the detailed drawing of beam, roof slab and lintel of multi-storied building.
3.4 Describe the process of making the detailed drawing of staircase, lift core and ramp of multi-storied building.
3.5 Mention the advantages of making the necessary drawings of multistoried framed structure building using CAD.

4 Understand the preparation of working drawing of RCC column with footing Foundation using CAD.
4.1 Describe the process of drawing the plan of square and rectangular column with footing showing the reinforcement.
4.2 Describe the process of drawing the sectional elevation of RCC column showing the reinforcement.
4.3 Describe the process of drawing the detailed working drawing of circular RCC column with footing showing reinforcement.

5 Understand the preparation of the working drawing of RCC lintel with sunshade and RB lintel using CAD.
5.1 Describe the process of making the detailed drawing of RCC lintel showing the reinforcement.
5.2 Describe the process of making the detailed drawing of RCC lintel with sunshade showing of reinforcement.
5.3 Describe the process of making the detailed drawing of RB lintel.

6 Understand the preparation of elevation and cross section of RCC cantilever retaining wall using CAD.
6.1 Describe the process of making the detail elevation of RCC retaining wall showing curtailment of reinforcement.
6.2 Describe the process of drawing the cross section of RCC retaining wall.
6.3 Describe the process of drawing the counterfort details showing reinforcement including retaining wall.

7 Understand the preparation of detailed drawing of foundation using CAD.
7.1 Describe the process of drawing the spread footing foundation.
7.2 Describe the process of drawing the raft foundation showing the reinforcement detail.
7.3 Describe the process of drawing the plan and sectional elevation of pile showing the reinforcement detail.
7.4 Describe the process of drawing the plan and sectional elevation of pile cap showing the reinforcement detail.
7.5 Describe the process of drawing plan and cross sectional elevation of well foundation showing the reinforcement.

8 Understand the preparation of working drawing of continuous rectangular beam and T-beam using CAD.
8.1 Describe the process of making the detail drawing of RCC fully continuous rectangular beam showing reinforcement.
8.2 Describe the process of making the detail drawing of RCC fully continuous T-beam showing reinforcement.
8.3 Describe the position of reinforcement in the junction of column with beam.

9 Understand the preparation of plan and section of one-way and two-way slab using CAD.
9.1 Describe the process of making the detailed drawing of semi-continuous one-way slab showing reinforcement.
9.2 Describe the process of making the detailed drawing of fully continuous one-way slab showing reinforcement.
9.3 Describe the process of making the detailed drawing of semi-continuous two-way slab showing reinforcement.
9.4 Describe the process of making the detailed drawing of fully continuous two-way slab showing reinforcement.

10 **Understand the preparation of plan and sectional elevation of a half turn staircase, ramp and lift core using CAD.**

10.1 Describe the process of drawing the plan of a half turn staircase.
10.2 Describe the process of drawing the sectional elevation of a half turn staircase.
10.3 Describe the process of making the detailed drawing of a half turn staircase showing reinforcement.
10.4 Describe the process of drawing ramp with showing reinforcement.
10.5 Describe the process of making the plan and section of lift core showing the reinforcement.

11 **Understand the preparation of plan and sectional elevation of an underground water reservoir and septic tank using CAD.**

11.1 Describe the process of drawing the plan and sectional elevation of an underground water reservoir showing the reinforcement.
11.2 Describe the process of drawing the plan and sectional elevation of a septic tank.
11.4 Describe the process of drawing the plan and section of soak pit and inspection pit.
11.5 Describe the process of detail drawing of a water closet including gully trap.

12 **Understand the preparation of detailed drawing of two span box culvert using CAD.**

12.1 Describe the process of drawing the sectional plan of a two span RCC box culvert.
12.2 Describe the process of drawing the cross section of a two span RCC box culvert.
12.3 Describe the process of drawing the long section of a two span RCC box culvert.
12.4 Describe the process of showing the arrangement reinforcement in a two span RCC box culvert.

13 **Understand the preparation of detailed drawing of T-beam decking bridge using CAD.**

13.1 Describe the process of drawing a half top plan and half plan (decking and earth removed) of RCC T-beam decking bridge with splayed type wing wall.
13.1 Describe the process of drawing the cross section of RCC T-beam decking bridge showing the reinforcement.
13.2 Describe the process of drawing of wing wall, turn wall, railing and bed block of RCC T-beam bridge.

14 **Understand the interpretation of the factory building drawing with steel truss.**

14.1 Name different components of a steel truss.
14.2 Describe the preparation of detail drawing for a factory building with steel truss.
14.3 Explain the necessity of interpretation the drawing of a factory building with steel truss.

15. **Understand the drawing about 3D using Auto CAD.**

15.1 Explain about starting 3D.
15.2 Explain how to create 3D objects / model.
15.3 Explain how to draw isometric view.
15.4 Explain about Edgesurf, Rulesurf, Tabsurf & Mesh.
15.5 Explain the uses of Co-ordinate system in Auto CAD.
15.6 Explain how to create surface modeling.
15.7 Explain the use of 3D editing commands.

16. **Understand the perspective view with rendering lighting & imaging in Auto CAD.**

16.1 Explain how to creating perspective view.
16.2 Describe the use of distance and camera in perspective view.
16.3 Describe the rendering and materials effect in 3D.
16.4 Describe the uses & set up of background in 3D.
16.5 Describe the lighting & shadow in 3D.
16.6 Describe the uses of showing images in 3D.
16.7 Explain how to print 3D view.

Practical:

1. Prepare plan, section and elevation of multi-storied building using CAD.
   1.1 Draw the site plan and layout plan of a multi-storied framed structure building.
   1.2 Draw the plan, elevation and sectional elevation of a framed structure building.
   1.3 Draw the detailed drawing of beam, roof slab and lintel of the building.
   1.4 Draw the detailed drawing of staircase, ramp and lift core of the building.
   1.5 Draw the RS plot map showing the site of the building with necessary items for approval of the relevant authorities.
2. Prepare the working drawing of RCC column with footing, raft and pile foundation using CAD.
   2.1 Draw the plan of square and rectangular column with footing showing the reinforcement.
   2.2 Draw the sectional elevation of RCC column showing the reinforcement.
   2.3 Draw the detailed working drawing of circular RCC column with footing showing reinforcement.
   2.4 Draw the detailed drawing of raft foundation.
   2.5 Draw the detail drawing of pile with pile cap.
3. Prepare the working drawing of RCC lintel with sunshade and RB lintel using CAD.
   3.1 Draw the detailed drawing of RCC lintel showing the reinforcement.
   3.2 Draw the detailed drawing of RCC lintel with sunshade showing reinforcement.
   3.3 Draw the detailed drawing of RB lintel.
4. Prepare elevation and cross section of cantilever RCC retaining wall using CAD.
   4.1 Draw the detailed elevation of RCC retaining wall showing curtailment of reinforcement.
   4.2 Draw the detailed cross section of cantilever retaining wall.
   4.3 Draw the counterfort details showing reinforcement including retaining wall.
5. Prepare the working drawing of continuous rectangular beam and T-beam using CAD.
   5.1 Draw the detailed drawing of RCC fully continuous rectangular beam showing reinforcement.
   5.2 Draw the detailed drawing of RCC fully continuous T-beam showing reinforcement.
   5.3 Draw the junction of column and beam showing the reinforcement.
6. Prepare plan and section of one-way and two-way slab using CAD.
   6.1 Draw the detailed drawing of semi-continuous one-way slab showing reinforcement.
   6.2 Draw the detailed drawing of fully continuous one-way slab showing reinforcement.
   6.3 Draw the detailed drawing of semi-continuous two-way slab showing reinforcement.
   6.4 Draw the detailed drawing of fully continuous two-way slab showing reinforcement.
7. Prepare the plan and sectional elevation of a half turn staircase using CAD.
   7.1 Draw the plan of a half turn staircase.
7.2 Draw the sectional elevation of a half turn staircase.
7.3 Draw the detailed drawing of a half turn staircase showing reinforcement.
7.4 Draw the detailed drawing of a ramp showing reinforcement.
7.5 Draw the detail drawing of a lift core showing reinforcement.
8 Prepare detailed drawing of underground water reservoir and septic tank using CAD.
8.1 Draw the plan and sectional elevation of an underground water reservoir showing the reinforcement.
8.2 Draw the plan and sectional elevation of a septic tank.
8.3 Draw the plan and section of soak pit and inspection pit.
8.4 Draw the detailed drawing of a water closet including gully trap.
9 Prepare detailed drawing of two span box culvert using CAD.
9.1 Draw the sectional plan of a two span RCC box culvert.
9.2 Draw the cross section of a two span RCC box culvert.
9.3 Draw the long section of a two span RCC box culvert.
9.4 Show the long section arrangement in the decking of the two spans RCC box culvert.
10 Prepare detailed drawing of T-beam decking bridge using CAD.
10.1 Draw a half top plan and half plan (decking and earth removed) of RCC T-beam decking bridge with splayed type wing wall.
10.2 Draw a sectional elevation of RCC T-beam decking bridge.
10.3 Draw the cross section of RCC T-beam decking bridge showing the reinforcement.
10.4 Show the details of T-beam of RCC T-beam bridge.
10.5 Show the details of wing wall, turn wall, railing and bed block of RCC T-beam bridge.
11 Prepare the drawing with steel truss using CAD.
11.1 Draw a drawing of steel truss for factory.
11.2 Draw a drawing of steel truss with simple building.

12 Perform the preparation of 3D objects in Auto CAD.
12.1 Create simple 3D object in Auto CAD.
12.2 Draw isometric view using snap & isoplanc command.
12.3 Create 3D surface by using 3D poly Edgesurf, Rulesurf, Tabsurf & Mesh.
12.4 Edit / draw 3D object using polar co-ordinate system.
12.5 Edit 3D object using different editing command i. e. align, rotate 3D, array 3D, mirror 3D, move, chamfer, fillet, trim etc.

13 Perform the preparation of the perspective view with rendering lighting & imaging in Auto CAD.
13.1 Set the distancet create perspective view.
13.2 Set the camera to draw the perspective view.
13.3 Draw perspective view of an object using 3D view command.
13.4 Set the material from material library for rendering.
13.5 Set the background color / image for rendering.
13.6 Set the light & create shadow using different command.
13.7 Draw perspective view of an object with full rendering.

REFERENCE BOOKS
1 Civil Engineering Drawing - Gur Charan Singh
2 Auto CAD 2000 - George Omura
3 Auto CAD 2000 - Engr. Samuel Mallikla
4 Auto CAD 2000 - Engr. Md Shah Alam
AIMS

- To be able to understand the modern techniques of construction management.
- To be able to understand the organization of contract department, pre-tender and post-tender planning.
- To be able to understand the operational research, site layout and organization.
- To be able to understand the mobilization of materials, equipment and construction safety.
- To be able to understand the quality and cost control.
- To be able to understand the maintenance, planning maintenance, supervision and execution of maintenance work in construction.
- To be able to understand the maintenance problems and its remedial measures.

SHORT DESCRIPTION

Principles of construction management; Organization of contracts department; Pre-tender and Post-tender planning; Public Procurement Rule; Operational research; Site layout and organization; Mobilization of materials and equipment; Safety in construction; Quality and cost control; Nature and importance of construction maintenance; Alteration and improvement of building; Planning maintenance work; Execution of maintenance work; Supervision of maintenance work; Maintenance problems and their solutions.

DETAIL DESCRIPTION

Theory:

1. Understand the principles of construction management
   1.1 Define management.
   1.2 State the functions of management.
   1.3 Describe the planning and executive functions of management.
   1.4 Define construction management.
   1.5 Establish the relation between management and construction management.
   1.6 Explain the necessity for scientific management in construction process.
   1.7 Describe the role of an engineer as a construction manager.
   1.8 List the organs of project management team (PMT).
   1.9 State the main objectives of a project management team.

2. Understand the organization of contracts department.
   2.1 Define organization.
   2.2 Describe organizational effectiveness in an organization.
   2.3 State the staffing pattern in an organization of contract department.
   2.4 Draw an organizational chart of a contracts department.
   2.5 Describe the responsibilities and authorities of the components of contracts department.
   2.6 List different government engineering department in Bangladesh.
2.7 Explain the role and responsibilities of the following within the engineering organization:

i) Chief Engineer (CE)
ii) Additional Chief Engineer (ACE)
iii) Superintending Engineer (SE)
iv) Executive / Divisional Engineer (XEN/DE)
v) Sub-Divisional Engineer (SDE)
vi) Asstt. Engineer (AE)
vii) Sub-Asstt. Engineer (SAE)
viii) Work Supervisor/Work Assistant.

2.8 Describe the common sections in a divisional office of an engineering department.

2.9 Describe the function and objectives of consultants for contracts department.

2.10 Describe different component of Development project proforma / proposal (DPP) of any construction project.

3 Understand the pre-tender planning.

3.1 Define pre-tender planning.
3.2 State the objectives of pre-tender planning.
3.3 List the activities of pre-tender planning.
3.4 State the procedural steps of entrusting a work to the contractor.
3.5 Define pre-qualification of contractors.
3.6 Describe the procedure of preparation of pre-qualification document.
3.7 Explain the procedure of preparation of evaluation criteria of pre-qualification document.

4 Understand the post-tender planning.

4.1 Define post-tender planning.
4.2 List the activities of post-tender planning.
4.3 Explain anticipation of award.
4.4 Define evaluation of contract.
4.5 Explain the silent features of evaluation of contract.
4.6 Describe the methods of work planning and management.
4.7 Explain construction stage, construction operation and construction schedule.
4.8 Describe the preparation of a construction schedule.
4.9 Explain the method of calculating project length.
4.10 Describe bar chart and its shortcoming and remedies.
4.11 State the meaning of the followings:
   a. Contract
   b. Tender
   c. Liquidated damage
   d. Extension of time
   e. Termination of contract
   f. Evaluation of contract
   g. Force major
   h. Performance security
   i. e-Tendering
   j. Technical Specification
   k. Working drawing
   l. Shop drawing.

5 Understand the recent public procurement rules (PPR) implemented by the govt. of Bangladesh.

5.1 State the background of PPR development in Bangladesh.
5.2 State the meaning of the following: PPR, ITT, TDS, GCC, PCC, NOA, BOQ, TEC, TOC, HOPE, CS, OTM, RFQ, DPM, CPTU.

5.3 Describe the preparation of standard tender document for works.

5.4 Describe the preparation of standard tender document for goods.

5.5 Describe the process of tender submission.

5.6 Describe the process of evaluation of tender document.

6 Understand the operational research in construction management process.

6.1 Define operational research.

6.2 State the necessity of network planning.

6.3 Classify network planning.

6.4 Describe the procedure construction network.

6.5 Define critical path method (CPM) and project evaluation & review technique (PERT).

6.6 Describe the process of construction CPM network.

6.7 Describe the process of drawing a PERT network.

6.8 Distinguish between CPM and PERT network.

6.9 Explain the following terms:
   a. Event
   b. Activity
   c. Duration
   d. Dummy activity
   e. Total float
   f. Free float

7 Understand the site layout and organization in construction management.

7.1 State different features of a site layout plan.

7.2 Draw a site layout plan of a construction site organization.

7.3 Describe the staffing pattern in site organization.

7.4 Draw an organization chart for site office.

7.5 Explain the role and responsibilities of the following staff within the organization:
   a. Resident Engineer/Site Engineer
   b. Contractor’s agent
   c. Sub-Asstt. Engineer
   d. Work Assistant
   e. Security officer and other staff.

7.6 Explain the need for liaison and co-operation between site engineer and contractor’s agent.

7.7 Describe the relation between:
   a. Site office and Head office
   b. Contractor and Head office

7.8 Explain the importance of site security.

8 Understand the mobilization of materials and equipment in construction management.

8.1 Define mobilization of materials and equipment.

8.2 Explain the procedure of receiving materials on site.

8.3 Draw a line plan of a material warehouse within the site.

8.4 Explain the procedure of removing materials from the site.

8.5 Classify the movement of materials on construction work.
8.6 List different equipment used in the construction process.
8.7 State the operation and maintenance of the following:
   a. Concrete mixer machine
   b. Concrete hoisting and conveying instrument
   c. Excavator tractor
   d. Crawler
   e. Crane (wheel mounted)
   f. Vibrator
8.8 Explain the following terms:
   a. Plant history card
   b. Depreciation
   c. Plant insurance
8.9 Draw a line diagram of a plant shed within the site.
8.10 Define resource management.
8.11 Explain the significance of resource management in construction.

9 Understand the safety measures to be taken in construction management.

9.1 Define safety measure.
9.2 State the nature of accidents in construction work.
9.3 Describe objectives, application and policy planning of safety program in construction work.
9.4 Draw a typical organization chart for safety group.
9.5 Describe the responsibility of employers and employees in respect of safety measure.
9.6 State the general safety requirements in construction works.
9.7 State different signals, signs and tags used in safety work.
9.8 Describe necessary safety measure in
   - material handling, storage and disposal,
   - handling of machinery and mechanical equipment and operating motor vehicles.
9.9 Explain the necessity of safety training for employees.
9.10 Explain the process of preparation of accident report.
9.11 Prepare an accident report to the employer.

10 Understand the quality and cost control process in construction management.

10.1 Define quality and cost control.
10.2 Describe the effects of lack of adequate quality control.
10.3 State the effects and benefit of quality control for
   - the contractor,
   - the designer and
   - the consultant.
10.4 Draw a flow diagram of a quality plan.
10.5 Describe the responsibilities to control the quality of construction of
   - the client,
   - the designer,
   - the manufacturer,
   - the contractor and
   - the supervisor.
10.6 Mention the requirements for an effective cost control system.
10.7 State the phases of a management cost and control system.
10.8 Explain cost reduction cycle.

11 Understand the nature and importance of construction maintenance.

11.1 Define maintenance.
11.2 Describe the types of maintenance.
11.3 Explain the significance of construction maintenance.
11.4 Explain the magnitude of construction maintenance in our country.
11.5 Describe the liability for defects in construction.
11.6 Explain the importance of considering maintenance implications at Design stage.
11.7 Establish the relation between the capital maintenance and running cost.

12 Understand the alteration and improvement of building.
12.1 State the basic criteria for alterations and improvements works.
12.2 List the most common operations in alteration and improvement work.
12.3 Describe the essential basic improvements that are needed in a large number of dwellings in Bangladesh.
12.4 Describe the sequence and management of alteration and improvement work.
12.5 Define rehabilitation and renovation.
12.6 State the advantages of rehabilitation and renovation work.
12.7 Distinguish rehabilitation from alterations and improvements.

13 Understand the planning of maintenance work.
13.1 State the need of planning maintenance work.
13.2 Mention the factors to be considered in formulating a maintenance policy.
13.3 List the procedural actions to be followed to outline maintenance policy.
13.4 Explain the nature of planned maintenance.
13.5 Explain the necessity of computerized maintenance program.
13.6 State the need of maintenance manuals.
13.7 Describe the contents of manuals.

14 Understand the procedure of execution of maintenance work.
14.1 List the agents usually execute the maintenance work.
14.2 List the variety of ways of notification of defects.
14.3 Explain control card and request card used in execution of maintenance work.
14.4 Define maintenance feedback.
14.5 Explain maintenance feedback and feedback report.
14.6 Describe the components of maintenance procedure.
14.7 Describe the coloured form (Red, White, Blue and Green) used in maintenance activity.
14.8 Describe the necessity of training for manager, supervisor and operatives for effective maintenance.
14.9 Explain the objective, scope and requirements of maintenance incentive scheme.

15 Understand the supervision of maintenance work.
15.1 State the main categories of supervisor of works.
15.2 Explain the duties of supervisor.
15.3 Define supervisor’s diary with example.
15.4 Explain different types of report.
15.5 Explain the features which should keep in mind during supervision of
   - demolition work,
   - excavation work,
   - conceal work,
   - brick work,
   - roofing,
   - plastering.
16 Understand different types of maintenance problems and their solution.

16.1 Describe the remedial of damage of walls due to settlement.
16.2 Explain the process of remedial measure of movement of walls associated primarily with the drying action of tree roots.
16.3 Describe the treatments which can be used to repair concrete floor with faulty DPC membrane.
16.4 Explain the process of overcoming the efflorescence and stains in brickwork.
16.5 Describe different causes of defects in precast concrete cladding and remedial action.
16.6 State the causes and remedial measures of the following plastering defects:
   a. Fine hair crack on the finished plaster
   b. Loss of adhesion
   c. Plaster surface sets too quickly
   d. Plaster surface soft and powdery with very fine crack
   e. Moisture trapped in new plaster.
16.7 Describe the process of repair a patch hole on bituminous pavement.

Practical:
1. Identify the plastering defects in a particular wall and rectify the problem.
2. Identify the efflorescence and stain in a brick wall and rectify the problem.
3. Identify water supply problem in institute building and solve the problem.
4. Identify a sanitation problem in your campus and solve the problem.
5. Draw a neat sketch of a construction site showing different components.
6. Identify patch hole in a bituminous surface and repair it.
7. Identify cracks in concrete floor in a building and repair the cracks.
8. Identify the damaged plaster in a wall of your institute and repair the plaster.
10. Prepare a CPM net work for a given set of data.
11. Prepare a PERT net work for a given a set of data.
12. Prepare a DPP of 6-storied building project for a given a set of data.
13. Prepare an accident report for an accident to the employer.

REFERENCE BOOKS
1 Introduction to Building Management (Fifth Edition) -RE Calvert
2 Construction Management (Second Edition) -PP Dharwadker
3 The Site Agents Hand Book - RHB Ranns
4 Building Organization & Procedures (Second Edition) - G Froster
4 Building Production and Project Management -R A Burgess and G White
5 The Resume of Building Construction & Management with CPM (Construction Concept) -Mohammed Ali Siddiquee
OBJECTIVES
- To develop knowledge and skill to prepare programs in C.
- To develop knowledge and skill to create, compile, debug & execute C programs.

SHORT DESCRIPTION
Basics of C program; Data types; Variables; Operators; Expressions; Input-Output statements; Branching and Looping statements; Arrays; preprocessors, Functions, Pointers; Structures and Unions; File operations and Graphics.

DETAIL DESCRIPTION
Theory:
1 Understand fundamentals of C Programming
   1.1 Describe the historical development of C Programs.
   1.2 Describe the Basic structure of C program and programming style.
   1.3 State the difference of C with other high level languages.
   1.4 Explain the process of program planning.
   1.5 Describe algorithm and flow chart.
   1.6 Prepare algorithm and flow chart for simple problems.
   1.7 State the process of compiling C program.
   1.8 Write simple programs using basic structure of C program.

2 Understand data types, constants and variables.
   2.1 Describe the data types in C.
   2.2 Explain constants and variables in C.
   2.3 Describe the keywords and identifiers in C.
   2.4 Mention the use of qualifiers in data types.
   2.5 Declare variables and assign values to variables.
   2.6 State the type conversion and type definition in C.
   2.7 Write simple programs using constants and variables.

3 Understand Operators and Expressions.
   3.1 State C operators and their classification.
   3.2 Describe the arithmetic, relational, logical, assignment, increment, decrement and conditional operators.
   3.3 Explain the bitwise and special operators.
   3.4 Write arithmetic expression & its evaluation.
   3.5 Describe the precedence of arithmetic operators.
   3.6 Mention operator precedence and associativity.
   3.7 Write simple programs using operators and expressions.

4 Understand the input and output operations.
   4.1. Describe the statement getting input from keyboard.
   4.2. Describe the statements printing output on screen and by printer.
   4.3 State the codes used for formatted I/O Statements.
   4.4 Mention the escape sequence in C.
   4.5 Write programs using I/O statements.

5 Understand the Branching and Looping Statements.
   5.1 Describe the conditional an unconditional branching flow.
   5.2 State the statement for conditional and unconditional branching.
   5.3 Explain the format for branching statements.
   5.4 Describe the conditional an unconditional Looping flow.
   5.5 State the statement for conditional and unconditional Looping.
   5.6 Explain the format for looping statements.
   5.7 Write programs using branching and looping statements.

6 Understand arrays
   6.1 Define arrays
   6.2 Describe the dimension of arrays.
   6.3 Initialize arrays.
   6.4 Write programs using arrays.

7. Understand preprocessor statements in C.
7.1 Describe the preprocessor directives and their functions.
7.2 Define header.
7.3 Describe the process of including header in routine.
7.4 Explain the use of macro.
7.5 Describe the advantage of macros over functions in programs
7.6 Write programs using preprocessor statements.

8 Understand pointer and its application.
8.1 Define pointer.
8.2 Describe the characteristics of pointer.
8.3 Explain pointer expressions.
8.4 Write programs using pointers.

9 Understand Function.
9.1 Explain library function and user defined function.
9.2 Describe the process of calling functions and returning values from functions in C.
9.3 Describe arguments used in functions.
9.4 Mention function prototype.
9.5 Write programs using library function and user defined function.

10 Understand structure and union.
10.1 Describe structure and union.
10.2 Mention structure and union declaration.
10.3 Distinguish between structure and union.
10.4 Write simple programs using structure and union.

11 Understand file operations.
11.1 Describe file operations.
11.2 State the modes of opening files.
11.3 Describe the functions that support character I/O.
11.4 Explain the routines for performing formatted I/O to files
11.5 Write programs for reading, writing and editing files.

12 Understand graphics elements and its application in C.
12.1 Define Text and Graphics
12.2 Describe how graphics are created in computers.
12.3 State the concept of pixel and resolution of CRT/LCD/LED display.
12.4 State the format and use of line( ), rectangle( ), bar( ), bar3d( ), Circle( ),
    ellipse( ), fillellipse( ) and sector( ) functions with example
12.5 State the format and use of Arc( ), pieslice( ), drawpoly( ) and fillpoly( )
    outtextxy( ) & settextrstyle( ), cleardevice( ), delay( ), sound( ) & nosound( ),
    functions with example
12.6 Mention the use of modified cprintf( ) and cscanf( ) functions for I/O
    operation.
12.7 Write program for developing color image using above graphics
    functions.
12.8 State the procedure of saving and loading an image in C.
12.9 Show the procedure to move text string on the screen.
12.10 Describe the statements used to copy and move text and graphics.
12.11 Write programs to create simple graphics.

Practical:
1. Perform the task to create, compile, debug & execute a C programs
   a) To print a message.
   b) To add two integer/float numbers.
2. Perform the task to create, compile, debug & execute a C programs using constants and variables
   a) To calculate the average of N numbers.
b) To convert the given temperature in Fahrenheit to Celsius and vice versa.
c) To calculate the area of a circle.
3. Perform the task to create, compile, debug & execute a C programs using operators and expressions.
a) To convert days to months and days.
b) To calculate the area of a triangle.
c) To compare two integer numbers
4. Perform the task to create, compile, debug & execute a C programs using I/O statements
   a) To read integer/real number.
   b) To find the sum of three floating point numbers from keyboard.
   c) To convert centimeter to inch using scanf () and Printf () statements.
5. Perform the task to create, compile, debug & execute a C programs using Branching Statements.
a) To select and print the largest number of three numbers.
   b) To compute the roots of a quadratic equation.
   c) To count vowels from a string of ten characters using switch statement.
6 Perform the task to create, compile, debug & execute a C programs using Looping Statements
   a) To print odd or even numbers from N numbers.
   b) To find the maximum or minimum number from a set of numbers.
   c) To search prime numbers.
7 Perform the task to create, compile, debug & execute a C programs using arrays
   a) To sort numbers in ascending or descending order using one dimensional array.
   b) To print numbers in two dimensional form.
   c) For matrix multiplication.
8 Perform the task to create, compile, debug & execute a C programs using preprocessor statements.
   a) To determine hypotenuse of right angled triangle using macro.
   b) To determine the area of a triangle using nested macro.
9 Perform the task to create, compile, debug & execute a C programs using pointers
   a) To illustrate the use of pointers in arithmetic operations.
   b) To compute the sum of all elements stored in an array.
10 Perform the task to create, compile, debug & execute a C programs using functions
    a) To calculate the area of a triangle
    b) To sort an array of integer numbers.
    c) To calculate factorial of any integer using recursive function.
11 Perform the task to create, compile, debug & execute a C programs using structure and union
    a) To store and retrieve data using structure.
    b) To store and retrieve data using union.
12 Perform the task to create, compile, debug & execute a C programs using files
    a) To store/read information to/from sequential file.
    b) To store/read information to/from random file.
    c) To convert lower case to upper case and vice versa.
13 Perform the task to create, compile, debug & execute a C programs using graphics
    a) To draw a line with different styles.
    b) To draw a circle with different colors.
    c) To generate nested ellipse.
14. To develop a complete project using C program that include text, graphics and sound in VGA mode.

Reference books and sites:
1. programming in C – E. Balagurusamy.
2. Teach yourself C _ Herbert Schildt.
3. www.e-booksdirectory.com › Computers & Internet
4. www.freebookcentre.net › Programming Languages Books
5. www.4shared.net/c+programming+ebook
AIMS

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

SHORT DESCRIPTION

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

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

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

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

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

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

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

7 Understand the basic concepts and techniques of decision making.
7.1 Define decision making.
7.2 Discuss the importance and necessity of decision making.
7.3 Discuss different types of decision making.
7.4 Describe the steps in decision making.

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

9. Understand the concept of inventory control
9.1 Define inventory inventory control.
9.2 Describe the function of inventory control.
9.3 Discuss the necessity and importance of inventory control.
9.4 Mention the advantages and disadvantages of inventory control.
9.5 Explain the following terms:
   - Bin card or Bin tag.
   - Purchase requisition.
   - Store requisition.
   - Material transfer note.
   - First in first out (FIFO).
   - Last in first out (LIFO).
   - PERT
   - CPM
   - NETWORK
   - MBO

10 Understand the concept of economic lot size & break even analysis
10.1 Define economic lot size.
10.2 Discuss the effects of over supply and under supply.
10.3 Describe the method of determination of economic lot size.
10.4 Explain the terms:
   - Safety stock
   - Determination of safety stock
   - Lead time
10.5 Define break even point and break even chart.
10.6 Explain the terms:
   - Break even analysis.
   - Fixed cost.
   - Variable cost.
10.7 Discuss the importance of break even analysis.
10.8 Describe the method of preparing break even chart.
10.9 Describe different methods of break even analysis.
10.10 Draw break even chart in different method.
10.11 Mention the advantages and disadvantages of break even analysis.

11 Understand the concept of Marketing and inventory control
11.1 Define marketing.
11.2 Discuss the function of marketing.
11.3 State the objectives of marketing.
11.4 Explain the terms:
   - Brand
   - Producer
   - Consumer
   - Customer
   - Copyright
   - Trade mark
11.5 Discuss product life-cycle and marketing strategies in different stages of a product life-cycle.
11.6 Define purchasing
11.7 Describe the five “R” of purchasing principles

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