L-4/T-1/WRE **Date : 30/06/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 425** (Structural Analysis and Design II)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. For the plane truss shown in Fig. 1, determine the nodal coordinate matrix, member connectivity matrix, combined load matrix, member stiffness matrix (in global axes) and global stiffness matrix. **(35)**

2. (a) Draw bending moment diagram of the beam shown in Fig. 2. Use flexibility method. Assume EI = constant for the entire beam. **(17½)**

   (b) Calculate deformation of the free degree of freedom of the beam shown in Fig. 3. Use stiffness method. Assume EI constant for the entire beam. **(17½)**

3. (a) Calculate deformation of the free degree of freedom of the frame shown in Fig. 4. Assume EI to be constant for all members. Ignore axial deformation. **(17½)**

   (b) Determine the stiffness matrix only for the frame shown in Fig. 5. Consider axial deformation. **(17½)**

4. (a) Derive the equilibrium equation for the plane frame shown in Fig. 6. Ignore torsional deformation. **(17½)**

   (b) For the truss shown in Fig. 7, find the bar force in member AD using stiffness method. **(17½)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Find the end moments for the frame shown in Fig. 8 resulting from the rotational yield of 'support A' 0.0016 radian clockwise. EI = 10000 k-ft^2. **(15)**

   (b) Analyze the frame of Fig. 9 by moment distribution. Find all reactions and draw bending moment diagram. **(20)**

Contd P/2

CE 425/WRE

6. (a) Analyze the beam in Fig. 10 using modified K for end B of member BC. EI constant. **(12)**

   (b) Draw bending moment diagram and sketch the deflected shape for the frame shown in Fig. 11. **(23)**

7. A railway viaduct is proportioned as shown in Fig. 12. Wind and moving train result in a lateral force of 40 kip at the top, as indicated. Find all joint moment and draw bending moment diagram. **(35)**

8. (a) Determine the ordinates of influence line for vertical reaction at support 'b' for the beam shown in Fig. 13. **(15)**

   (b) Compute the ordinates at 3 ft intervals of the influence line for the moment at the mid-span section 'd' of 'ab beam' shown in Fig. 14. **(20)**

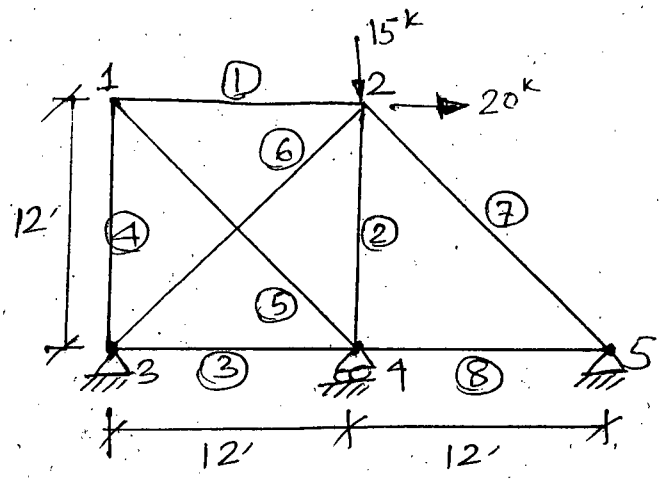


Fig. 1.

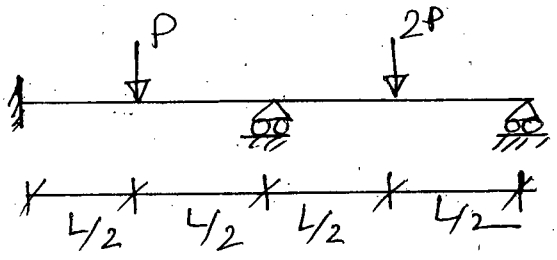


Fig. 2.

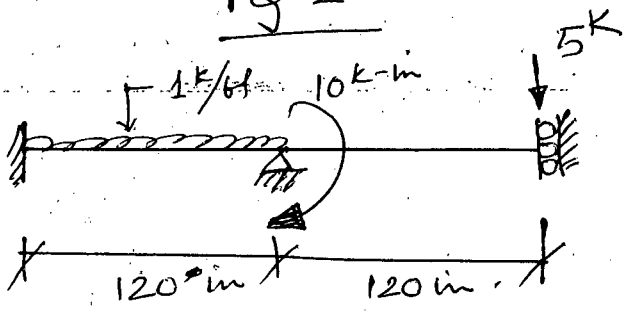


Fig. 3.

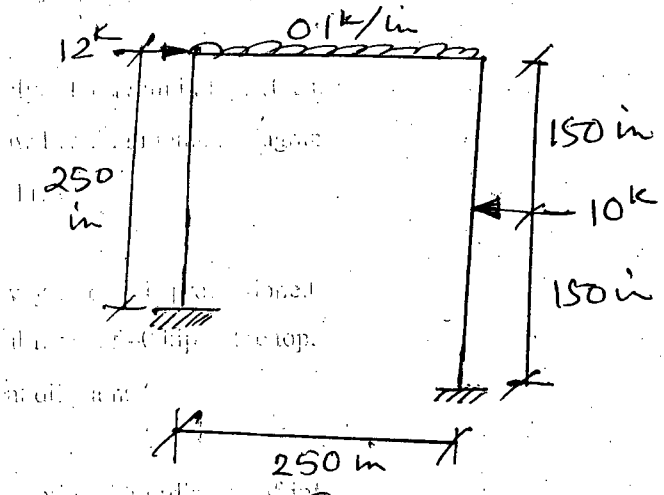


Fig. 4

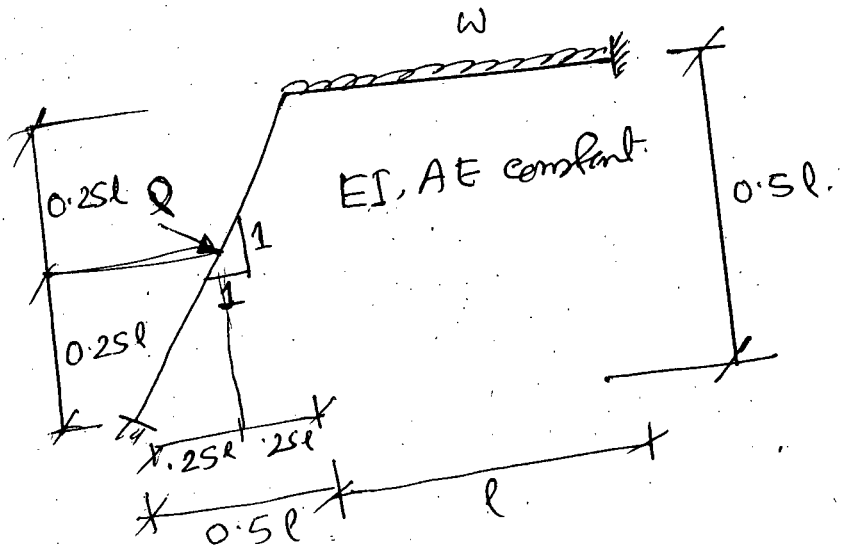


Fig. 5.

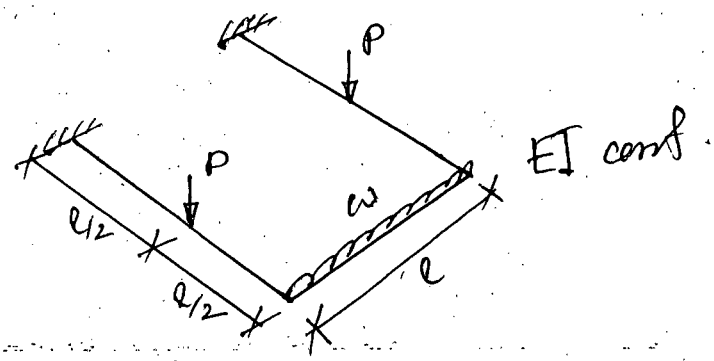
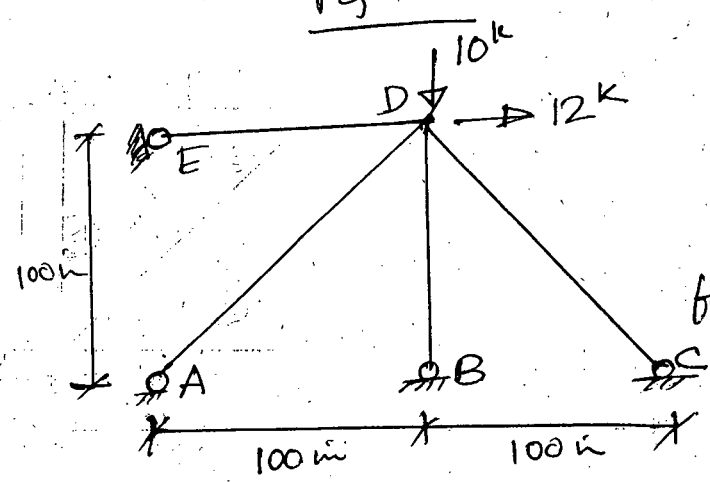


Fig. 6.



$A = 10\ in^2$
$E = 3000\ ksi$
for all members.

Fig. 7.

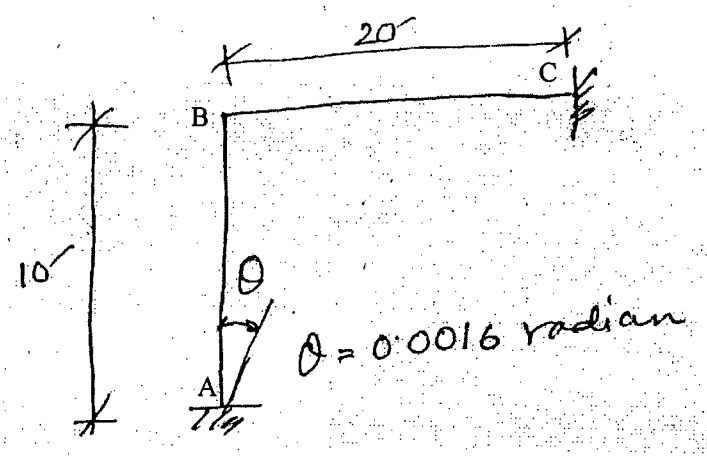


Fig. 8

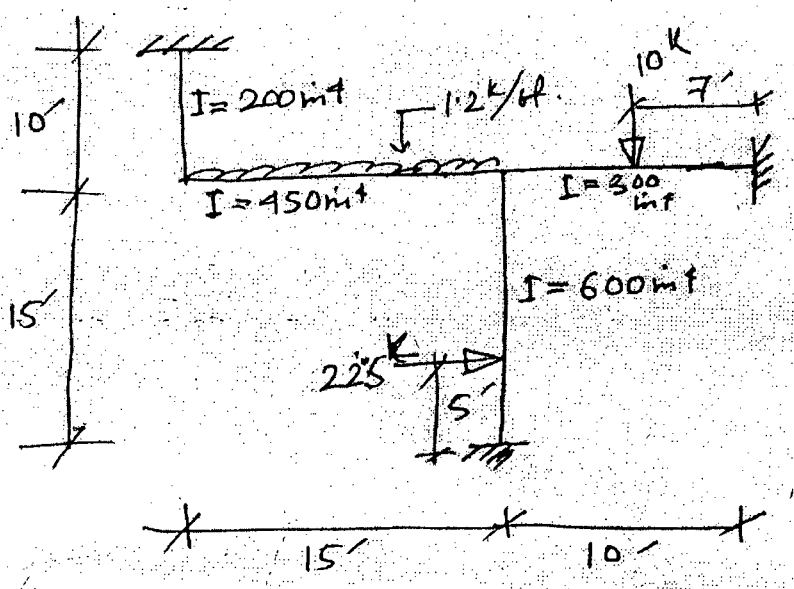


Fig. 9

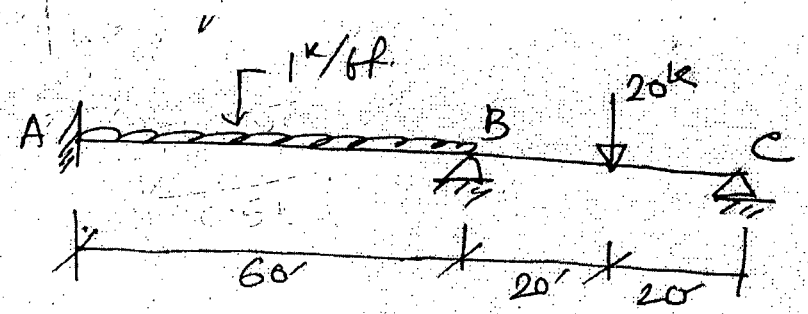


Fig. 10

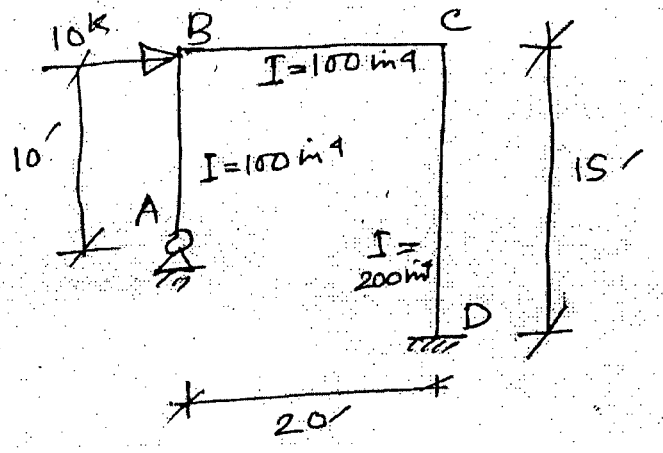


Fig. 04 11

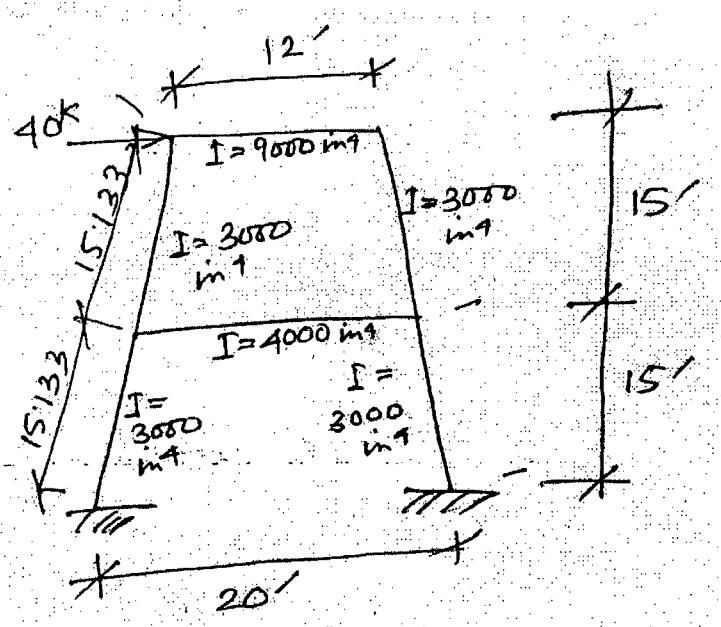


Fig. 05 12

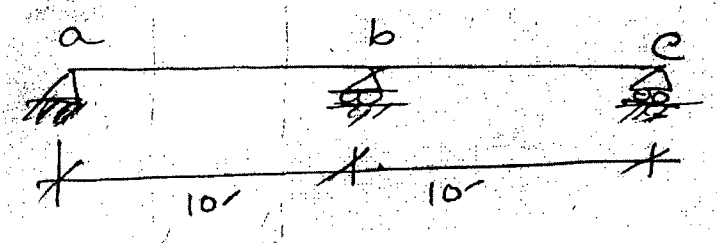


Fig. 06 13

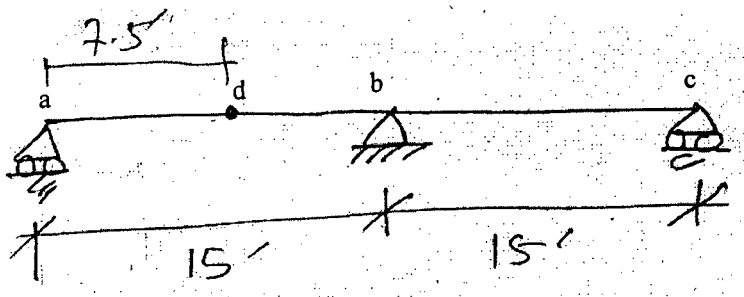


Fig. 07 14

L-4/T-1/WRE **Date : 07/07/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **WRE 415** (Water Resources Planning and Construction Management)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Briefly describe the components of a water resources system and their interaction. (8)

   (b) Enumerate the purposes of water resources development and management. (8)

   (c) Distinguish between planning and design. Explain why modern water resources Planning is more complex than traditional approach. (9)

   (d) Briefly describe the generalized process of water resources planning and management. (10)

2. (a) Distinguish between (i) economic analysis and financial analysis (ii) direct benefits and indirect benefits (iii) direct construction cost and engineering costs. (9)

   (b) A present investment of Tk 100000 is expected to yield a return of Tk 10,500 a year for 15 years. What is the approximate rate of return? (10)

   (c) A water supply project is planned to be constructed with an initial cost of Tk 80×10^6 and the useful life of the project would be 20 years. The interest rate on borrowed capital is 8% and the annual O ⊄ M cost would be Tk 10×10^6. It is expected that the sale of water would be 1.0×10^6 m^3 per year during the first 10 years and $2.0\times10^6 m^3$ per year during the second 10 years. At what constant price should the water be sold in order to be able to liquidate the project at the end of 20 years without debt, nor profit? (16)

3. (a) What are the objectives of environmental assessment of water resources project? Briefly outline the key steps in the environmental assessment process. (12)

   (b) State the functions of major water resources organizations in Bangladesh. Also enlist the criteria for evaluating institutional structure. (11)

   (c) What are the benefits of social impact assessment? Briefly describe the procedure of social impact assessment of a water resources project. (12)

4. (a) What is meant by project formulation? Briefly discuss the 3 stages of studies involved in formulation of a single engineering project. (12)

   (b) What do you mean by project appraisal? Briefly outline the four tests for formulating alternative plans. (8)

   (c) Distinguish between master planning and comprehensive planning. Discuss the outline of a comprehensive planning report for a river basin. (15)

Contd P/2

WRE 415

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Write down the objectives of construction management. (8)

(b) Briefly explain the function of construction management. (12)

(c) What are the guidelines for establishing Work Breakdown Structure (WBS). Construct a WBS for a 3 span deck girder bridge to be constructed in Bandharia Upazilla of Pirojpur. (7)

(d) A small single story commercial building is to be constructed on the site of an existing old structure. The exterior and interior walls are of concrete blocks, the roof is erected from steel members covered with rigid insulation and build up roofing. The ceiling is of suspended tile. The floor is a concrete slab with asphalt finish. Interior finish on all walls is paint. The project has been broken down in to 18 activities with estimated construction time shown below. Specify the predecessors of each activity. Note that the activities are not given in any order. (8)

Activity	Estimated Duration (days)	Activity	Estimated Duration (days)
Underground services (water & sewage services)	1	Rough plumbing	3
Exterior walls	6	Rough electrical	3
Foundations	3	Rough carpentry	2
Demolition	2	Finish plumbing	4
Interior walls	3	Finish electrical	3
Floor slab	3	Finish carpentry	4
Floor finishing	2	Ceiling	3
Roof Steel	2	Windows	1
Roof Finishing	2	paint	1

6. (a) What is called contract? Write down the components of a typical contract document. (12)

(b) Write down the advantages and disadvantages of Lump-sum contracts. (8)

(c) Define the two different types of performance indices. Also interpret their standard values. (7)

(d) What is the duration required to install 6000 square feet of walls shuttering if a crew of 2 carpenters is used and the output is 200 square feet/day. (8)

7. (a) Write short notes on the following.

(i) Optimistic time and most likely time

(ii) Dummy activity (9)

(iii) Human factor in construction management

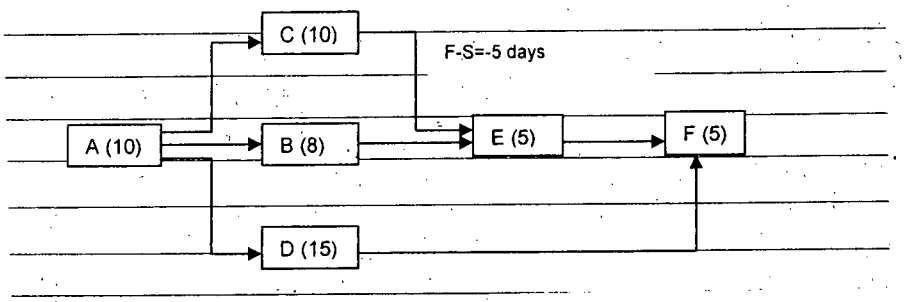
Contd P/3

WRE 415

Contd ... Q. No. 7

(b) Define successor/predecessor activity. How many types of successor/predecessor relationship are possible? Explain with examples. (12)

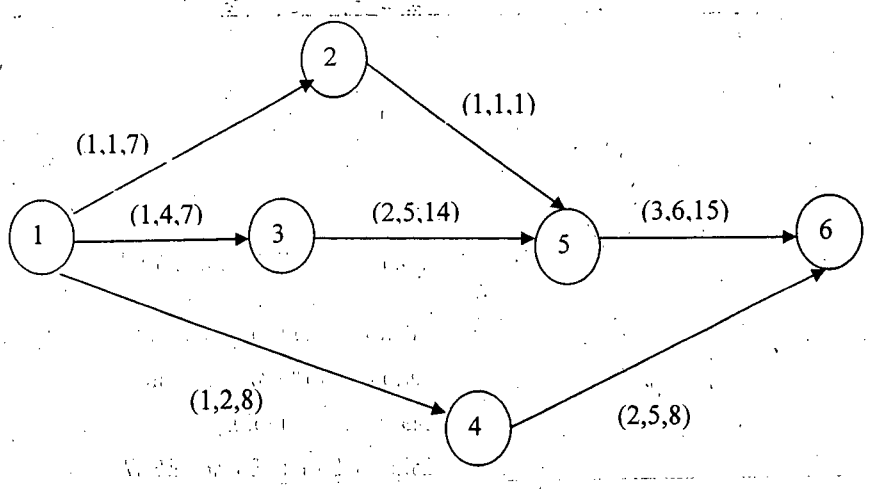
(c) Calculate start, finish and float for each activity in the following CPM precedence network diagram. All the durations are in days. Activity C and E have an F-S relationship with a 5 days lag. (14)



8. (a) Write down the site constraints in considering selection of construction equipments. (7)

(b) Define AoA and AoN. What are the differences between the two network diagrams? (8)

(c) The three time estimates: the optimistic time, the most likely time, pessimistic time (t_o, t_m, t_p) are given in weeks in the diagram for each activity. (20)



(i) Determine the critical path and the expected time required for the completion of the project.

(ii) Calculate the probability of completing the project in 20 weeks.

(iii) Calculate the project completion time assuming the probability to be 90%

Z	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
probability	50	59.87	69.15	77.34	84.13	89.44	93.32	95.99	97.72

L-4/T-1/WRE **Date : 01/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **WRE 417** (Groundwater Engineering)

Full Marks: 140 Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Define : Unconfined aquifer, porosity, transmissivity and storage coefficient. (8)

   (b) Draw a neat sketch showing sub-surface water distribution in a vertical soil profile. (8)

   (c) Discuss the 'recharge well method' for artificial recharge of groundwater. $(7\frac{1}{3})$

2. (a) What are the industrial sources and causes of groundwater pollution? (8)

   (b) Describe the sub-surface geo-physical methods for groundwater exploration. (8)

   (c) An isotropic aquifer has three different layers. The thickness of the top, middle and bottom layers are 10m, 12m and 8m respectively. The hydraulic conductivities of the top, middle and bottom layers are 5 m/d, 0.05 cm/s and 2 m/d respectively. Determine the equivalent horizontal and vertical hydraulic conductivities. $(7\frac{1}{3})$

3. (a) State and explain Darcy's law of groundwater movement. Write down the conditions for validity of Darcy's law. (8)

   (b) What are isotropic and anisotropic aquifers? Derive equivalent horizontal and vertical hydraulic conductivities. (8)

   (c) What are the purposes of artificial recharge of groundwater? $(7\frac{1}{3})$

4. (a) Illustrate the interrelations of groundwater levels, recharge and evapotranspiration fluctuations with a neat sketch. (8)

   (b) Discuss the various techniques of surface investigation of groundwater. (8)

   (c) Define 'groundwater basin'. Write short note on 'spring'. $(7\frac{1}{3})$

Contd P/2

WRE 417

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Show that for steady unidirectional flow in a confined aquifer, the head decreases linearly with distance. ($5\frac{1}{3}$)

   (b) Derive the equation for steady state discharge from a well in an unconfined aquifer. State the assumptions made in the derivation. (6)

   (c) A well penetrates into an unconfined aquifer having a saturated depth of 40 m. The discharge is 200 l/min at 5 m drawdown. Assuming equilibrium flow conditions and a homogeneous aquifer, estimate the discharge at 8 m drawdown. The radius of influence may be taken to be equal for both the cases. (12)

6. (a) Write short notes on (i) Multiple well system; (ii) Partial penetration of a well in a confined aquifer. (6)

   (b) Discuss the Cooper-jacob method of determining aquifer constants T and S from pumping test data. (10)

   (c) Why is it recommended to conduct recovery test after a pumping test? Explain how the aquifer transmissivity is determined from recovery test data. ($7\frac{1}{3}$)

7. (a) Give a comparison between cable tool method and reverse circulation rotary method of well drilling. (6)

   (b) What are the causes of failure of a well? What remedial measures are to be taken to rehabilitate the well in each case? ($5\frac{1}{3}$)

   (c) Preliminary test shows that a tubewell can yield 1800 l/min from a confined aquifer of thickness 20 m. The aquifer sand has D_{10},D_{50} and D_{60} of 0.23, 0.60 and 0.67 mm respectively. (i) Determine the length of well screen if its diameter and effective open area are 25 cm and 15% respectively. (ii) Design the gravel pack. (12)

8. (a) What are the sources of saline water in aquifers? Briefly outline the various methods of controlling saline water intrusion in aquifer. (12)

   (b) Enlist the sequence of activities proceeding start of a groundwater management investigation. (6)

   (c) Briefly discuss the feasibility study for groundwater management. ($5\frac{1}{3}$)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **WRE 427** (GIS and Remote Sensing)

Full Marks: 140 Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What is remote sensing? Describe briefly the basic components of satellite remote sensing process with a neat diagram. (5 1/3)

   (b) Show the interaction of electromagnetic energy with particles in the atmosphere in a neat sketch. Explain Mie scattering process with example and sketch. (6)

   (c) Explain the significance of ozone and water vapor in remote sensing. For sun, find out the ratio of emittance at 0.483 μm to total emittance. Given, sun emits maximum radiations at 0.483 μm. (6)

   (d) Derive Stefan-Boltzmann law from Plank's radiation law. (6)

2. (a) What is polarization? Write short note on radar polarimetry. (5 1/3)

   (b) (i) Most remote sensing systems avoid detecting ad recording wavelengths in the ultra-violet and blue portion of the spectrum. Explain why this would be the case. (6)

   (ii) Write down the relative advantages of active and passive remote sensing.

   (c) (i) 'A particular object may not have the same backscatter response on all radar images, particularly airborne versus spaceborne radars'- list some of the factors which might account for this.

   (ii) Determine the height of a mountain from the information of radar shadows of that object:

   aircraft altitude – 2 km, slant range to far end of shadow = 8 km, slant range length of shadow = 5.5 km.

   (d) What types of geometric distortions do you expect in a radar image taken over a mountainous area? Explain with sketches. (6)

3. (a) Write short note on one weather satellite and one marine observation satellite. (5 1/3)

   (b) Compute land surface temperature (LST) using atmospheric correction method, from the following observations obtained from a Landsat 7 (high gain) mission over a remote area: (7 1/2)

Contd P/2

WRE 427

Contd ... Q. No. 3(b)

Band 6: Digital number (DN) = 220;
Band 2: DN = 15
Band 3: DN = 60
Band 4:DN= 220
Day of the year = 230; earth-sun distance = 1.0122 (astronomical unit), solar zenith angle = 25.49 degree, calibration constant k1 = 666.09 and k2 = 1282.71; NDVImax= 0.87, NDVImin = 0.55; BTmax = 322 K and BTmin = 300K, atmospheric vapor content =1.2 g/cm^2, upwelling radiance = 0.5 [W/(m^2.sr.μm)], and downwelling radiance = 0.84[W/(m^2.sr.μm)]. Use Table 1 for information regarding different bands of Landsat 7. Assume reasonable value if any data is missing.

(c) Compute NDVI, EVI, SAVI, TCI, VCI and VHI from the data given in Q3(b). (7 1/2)

(d) Explain why the use of a synthetic aperture radar (SAR) is the only practical option for radar remote sensing from space. (3)

4. (a) What are the advantages of using multitemporal, multispectral, and muultisensor data in remote sensing? (5 1/3)

(b) What are the benefits of using remote sensing in i) crop monitoring and damage assessment and ii) soil moisture monitoring? Write down the input data requirements for monitoring crop and soil moisture from satellite platform. (6)

(c) Calculate i) incoming shortwave solar radiation, ii) incoming and outgoing longwave radiation, iii) net radiation and iv) soil heat flux from the following data: (6)
Solar constant, G_{sc} = 1367 W/m^2, solar inclination = 0.79 radian, d = 1.01225 [astronomical units], elevation above mean sea level = 120m, Stefan-Boltzmann constant = 5.67*10^{-8} Wm^{-2}K^{-4}, near surface temperature = 23°C, surface temperature = 25°C, NDVI = 0.75, surface albedo = 0.23.

(d) Write short note on i) Geostationary satellite, ii) Sun-synchronous satellite, iii) Blackbody radiation. (6)

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.
Question No. 1 is compulsory and answer any two from the rest.

5. (a) Write short note on any two types of interpolation techniques available in GIS. (3+3)

(b) Briefly discuss the following terms with schematic diagram
i) Georeferencing ii) Pseudo nodes iii) Symdifference (2+3+3)

(c) Write short description on Triangular Irregular Network. (3)

Contd P/3

WRE 427

Contd ... Q. No. 5

(d) What do you mean by UTM coordinate system? Distinguish UTM and military grid coordinate system. (4+3)

(e) What are the function of space and user segment of GPS? (3+3)

6. (a) Write down the name of different types of data models available; also give a short description on their applications. (6)

(b) Write short note on

i) Convex hull ii) Network Data Model (3+3)

(c) What are the different types of raster overlay? (2)

(d) Write down the classification of azimuthal projection. Distinguish different geometric models of projection. (3+3)

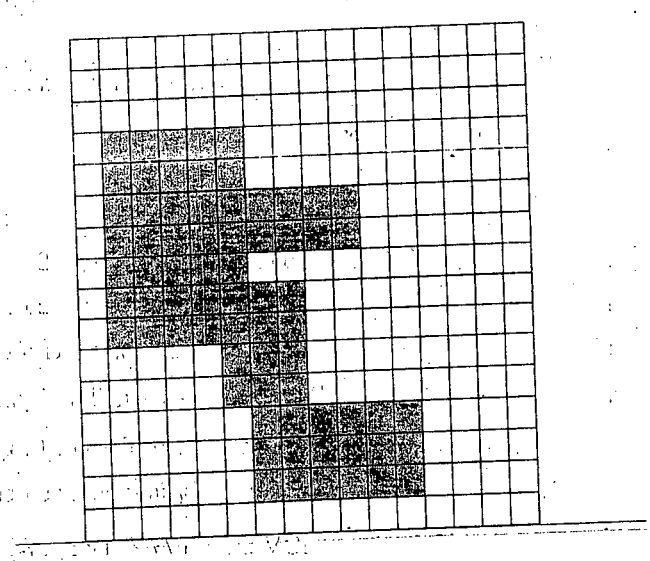
7. (a) Define Topology in GIS. What are the different types of topological tests used in GIS for data validation? (2+5)

(b) What are the different types of GPS errors available? Briefly discuss any two of the GPS errors. (2+4)

(c) What are the different generalization techniques available in GIS? Discuss with necessary diagrams. (3+4)

8. (a) What do you mean by vector overlay in GIS? Discuss different types of vector overlay. (2+4)

(b) Use raster compression technique Quadtrees to represent the following raster. (5)



(c) What do you mean by raster and vector data? Give two examples with description where raster data is more suitable than vector data. (3+3)

(d) Distinguish run length encoding and block encoding used in GIS. (3)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **WRE 419** (Irrigation and Drainage Engineering)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Distinguish between (i) field capacity and permanent wilting point (ii) Soil moisture tension and piezometric head (iii) available water and readily available water. (9)

(b) Briefly describe the working principle of a tension-meter with a neat diagram. Explain why this device is most useful in sandy soils. (8)

(c) Piezometers a and b are installed side by side in a field at depths16 m and 2m below the land surface. The pressure heads are 23 m and 3m respectively. If the hydraulic conductivity of the soil is 2m/yr calculate the annual movement of water through the soil. (8)

(d) The field capacity and permanent wilting point of a soil are 27% and 12% respectively. The dry density of the soil is1350 kg/m^3 and the depth of root zone is 90 cm. The moisture content of the soil on March 6 is 25%. Determine the date and amount of next irrigation if the predicted crop evapotranspiration rate is 7 mm/day and maximum allowable depletion is 50%. Assume no rainfall during the period. (10)

2. (a) Define consumptive use and effective rainfall. List the factors affecting them. (8)

(b) Describe with figures different types of lysimeter used to determine consumptive use of fields crops. Also indicate the condition under which each type is most suitable. (9)

(c) Define (i) water storage efficiency (ii) water-distribution efficiency. Briefly discuss the importance of these concepts. (7)

(d) Wheat is to be grown at a certain place and the useful data are given below. Calculate the monthly consumptive use applying Blaney-Criddle equation. Also calculate the field irrigation requirement assuming water-application-efficiency as 70%. (11)

Month	Mean Temperature (°C)	Percent day time hrs	Crop factor	Effective rainfall (cm)
Nov	18.0	7.2	0.75	1.7
Dec	16.5	7.3	0.85	1.4
Jan	13.5	7.5	0.80	3.0
Feb	14.7	7.1	0.70	2.3

3. (a) What are the salient points of difference between (8)

(i) check flooding and basin flooding (ii) furrow irrigation and subirrigation.

(b) Define irrigation management. Briefly describe the Components of an irrigation scheme management. (8)

Contd P/2

WRE 419

(c) "Sprinkler irrigation is an excellent method but not widely used in our country" – Discuss. (8)

(d) A stream of 105 l/s was delivered to a field of 2.0 ha for 8 hours. The average depth of rooting was 1.1 m and the runoff loss was measured as 600 m^3. The average depth of water penetration in each 0.25 ha segment of the field was : 0.82, 0.98, 1.1, 1.22, 1.07, 0.90, 0.85 and 1.1 m. Determine the water – application water-storage and water distribution efficiencies. (11)

4. (a) Give comparison with figures between (i) a weir and a barrage (ii) a cross-regulator and a head regulator (iii) a weir type escape and a regulator type escape. (12)

(b) What are the requirements of a good module? Briefly describe the different types of module. (8)

(c) What do you mean by characteristic curves of a pump? Explain how these curves are used to select a pump. (8)

(d) A pump lifts 250 m^3 of water per hour against a total head of 15 m. Compute the cost of energy in a mouth of 30 days of the pump is operated 12 hours a day and the electric cost is Tk. 5.0 per unit. Assume that the efficiencies of the pump and motor are 70% and 90% respectively. (7)

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Discuss the importance of irrigation. (5)

(b) Write short notes on: (15)

i) Leaching

ii) Disadvantage of irrigation

iii) Intensity of irrigation

(c) What is meant by C2-S2 water? Discuss its usefulness for irrigating fine textured soil. (5)

(d) The culturable command area for a distributary is 15000 ha. The intensity of irrigation for wheat is 40% and for rice is 15%. If the total water requirement of the two crops are 37.5 cm and 120 cm and their periods of growth are 160 days and 140 days respectively, determine the outlet discharge from average demand consideration. (10)

6. (a) Define 'berm' of an irrigation canal with necessary sketch and write its advantages. (8)

(b) Design an earth canal section using Kennedy's theory for the data given below

Canal discharge = 40 m^3/s

Canal bed slope = 1 in 5250

Critical velocity ratio = 1.085

Manning's n = 0.021

Contd P/3

WRE 419

Contd ... Q. No. 6

(c) Compare briefly the silt theories of Kennedy and Lacey. (8)

(d) Explain various types of canal seepage Losses. (7)

7. (a) Differentiate between alluvial and non-alluvial canals. (5)

(b) What is water logging? Write down the basic causes of water logging. (10)

(c) Write short notes on: (10)

i) Ill effects of water logging

ii) Canal alignment.

(d) Design an irrigation canal using Lacey theory for the data given below. (10)

Discharge, Q = 50 cumec

grain size, d_{50} = 0.15 mm

8. (a) What are the benefits of drainage system? (7)

(b) What is meant by 'closed drains'? (10)

Write down the advantages and disadvantages of 'closed drains'.

(c) Explain preventive anti-water logging measures. (6)

(d) Calculate the balancing depth for a channel section for the figure below having a bed width equal to 18 m and side slopes of 1:1 in cutting and 2:1 in filling. The bank embankments are kept 3.0 m higher than the ground level and crest width of banks is kept as 2.0 m. (12)