BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2014-2015

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

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**.

Assume reasonable missing data, if any.

1. (a) What is the moment carried over to a fixed end of a member when the other end is
   subjected to a certain moment? Prove your answer.   **(7)**

   (b) Draw shear force and bending moment diagram of the beam shown in Fig. 1. Use
   modified stiffness for member AB and CD. Analyze the beam by moment distribution. EI
   is constant.   **(28)**

2. (a) Determine the final member-end moments for the frame shown in Fig. 2.   **(23)**

   (b) Construct the influence line for moment at section 4 of the beam shown in Fig. 3.
   Determine ordinates at sections 1 to 6 as shown in Fig. 3. Use moment distribution.   **(12)**

3. (a) Using stiffness method, determine the displacement at nodal coordinate 1 and 2 of the
   truss as shown in Fig. 4. Also determine the reaction forces at nodal co-ordinates 3, 4, 5
   and 6.   **(26)**

   (b) Define element, nodes, co-ordinate, force, displacement and stiffness regarding matrix
   method of analysis.   **(9)**

4. (a) Derive the member stiffness matrix for a beam element shown in Fig. 5.   **(17)**

   (b) Determine the stiffness matrix of the frame shown in Fig. 6. Given, $I = 180 \times 10^6 \text{ mm}^4$,
   $A = 6000 \text{ mm}^2$ and E = 200 GPa. (for both members).   **(18)**
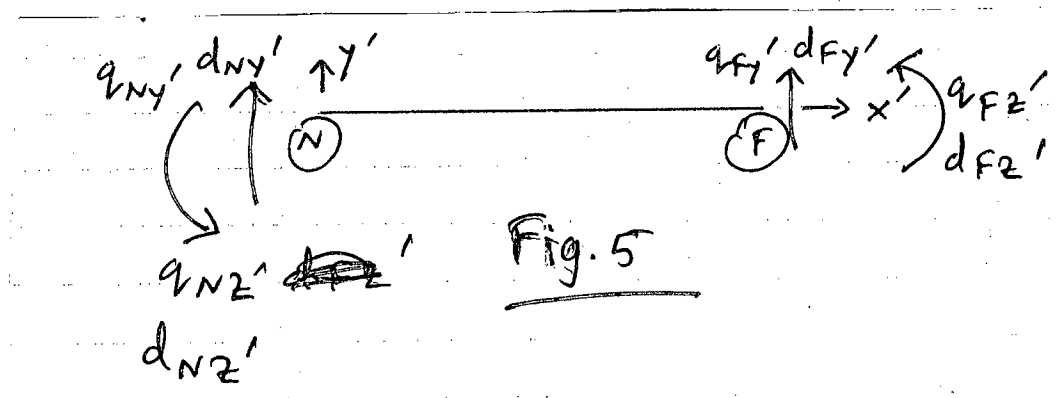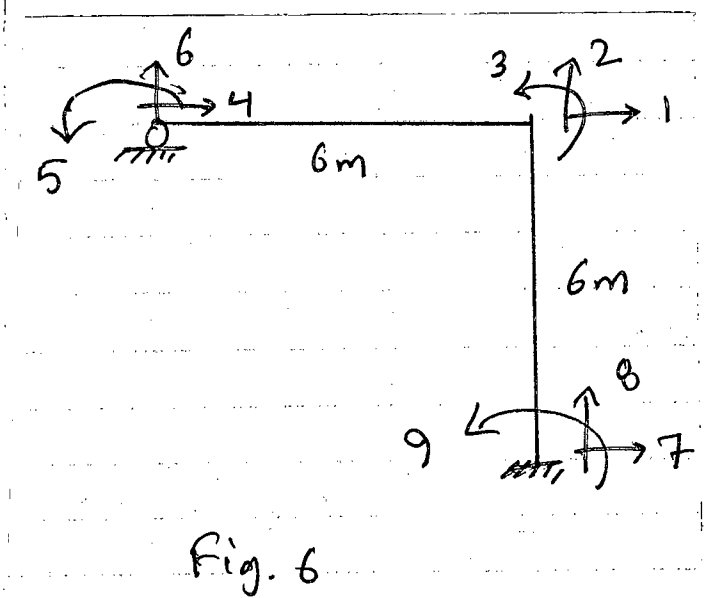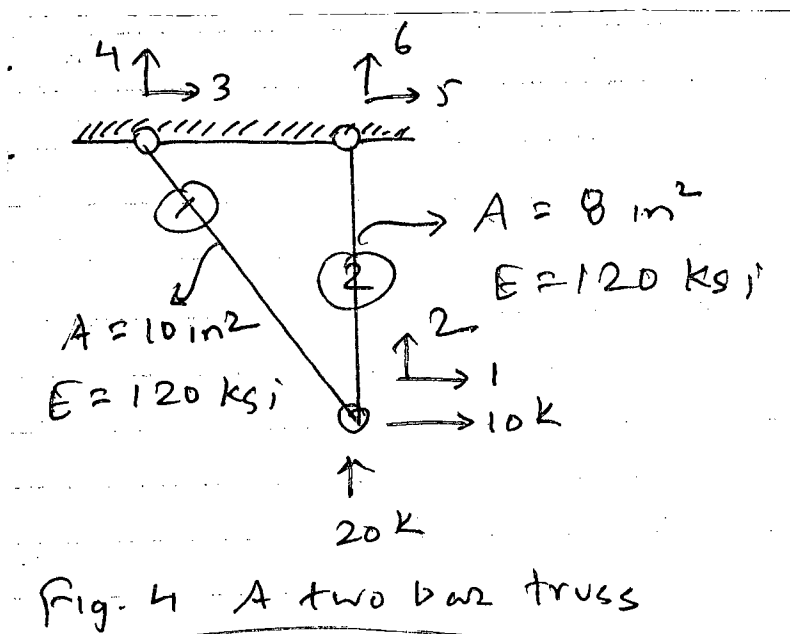
SECTION – B
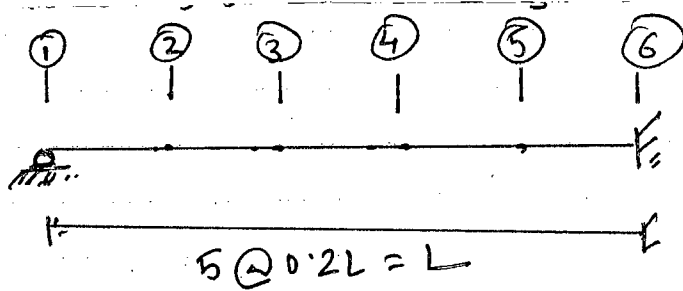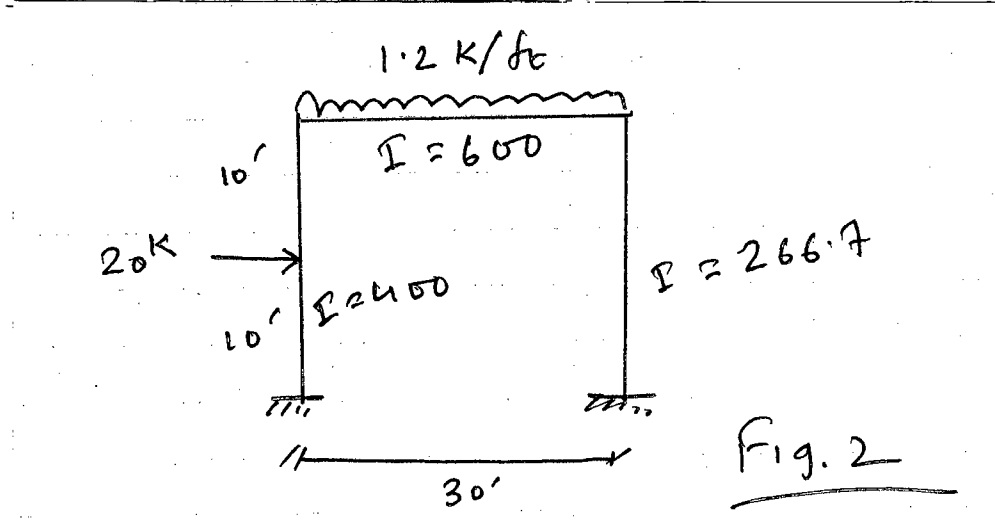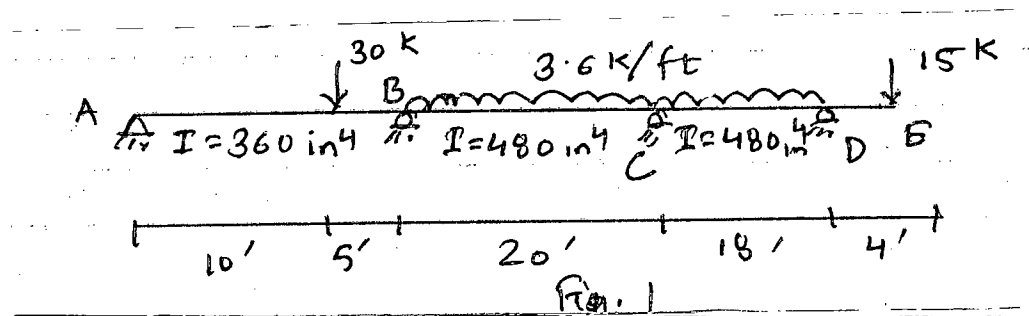
There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Analyse the truss in Fig. 7 by the consistent deformation method (E = constant). The
   numbers in parentheses are the cross-sectional areas of the members in sq.cm.   **(29)**

   (b) State the Muller-Breslau principle.   **(6)**

CE 425/WRE

6. (a) Analyse the frame in Fig. 8 by the consistent deformation method and draw the bending moment diagram (EI = constant). **(29)**

(b) Show two possible primary (released) structures and redundants for the structures in Fig. 9. **(6)**

7. (a) Analyse the beam in Fig. 10 if the downward settlements of supports B and C in ton-m units are 200/EI and 100/EI respectively. (EI = constant). Neglect axial. Use either consistent deformation method or stiffness method. **(25)**

(b) For the frame in Fig. 11, draw the qualitative influence lines for (i) maximum positive bending moment at P, (ii) maximum negative bending moment at B of the beam BC and (iii) maximum axial force in column CE. Show also the corresponding loading pattern for uniformly distributed live load for each of them. **(10)**

8. (a) Compute the force in the tie rod (Fig. 12). Include the effect of both axial and bending (E is constant). Use the consistent deformation method. **(25)**

(b) Draw qualitative influence lines for bending moment at B and A, shear force at A and reaction at B of the continuous beam in Fig. 13. **(10)**
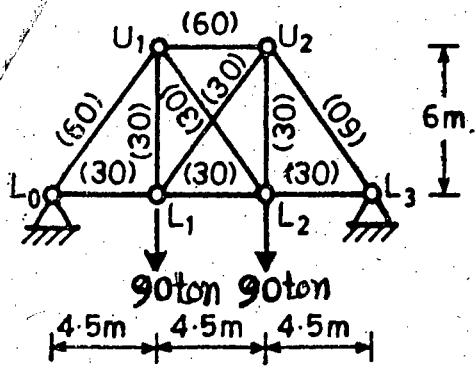

Fig. 1

30^K $3.6 K/ft$ 15^K

B

A $I = 360 in^4$ $I = 480 in^4$ $I = 480 in^4$ D   E

C

$10'$ $5'$ $20'$ $18'$ $4'$

Fig. 1

Fig. 2

$1.2 K/ft$

$10'$ $I = 600$

$20^K \rightarrow$

$I = 400$ $I = 266.7$

$10'$

$30'$

Fig. 2

Fig. 3

① ② ③ ④ ⑤ ⑥

$5 @ 0.2L = L$

Fig. 3

Fig. 4

$4 \uparrow \rightarrow 3$ $6 \uparrow \rightarrow 5$

① $\rightarrow A = 8 in^2$

② $E = 120 ksi$

$A = 10 in^2$

$E = 120 ksi$ $2 \uparrow \rightarrow 1$

    $\rightarrow 10K$

$\uparrow 20K$

Fig. 4   A two bar truss

Fig. 6

$6 \uparrow$

$5 \quad \rightarrow 4$ $3 \leftarrow \uparrow 2 \rightarrow 1$

$6m$

$6m$

$9 \leftarrow \uparrow 8 \rightarrow 7$

Fig. 6

Fig. 5

$q_{Ny}', d_{Ny}' \uparrow y'$ $q_{Fy}', d_{Fy}' \nwarrow$

N   F $\rightarrow x'$ q_{Fx}'

q_{Nx}', d_{Nx}' d_{Fx}'

Fig. 5

Fig. # 7

Fig. # 8

(i)　　　　(ii)
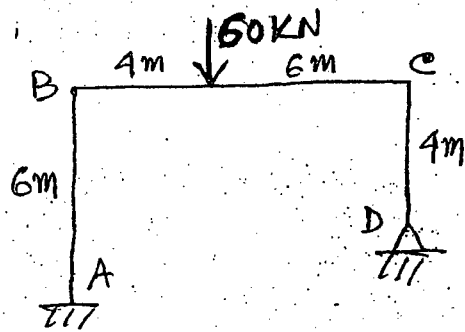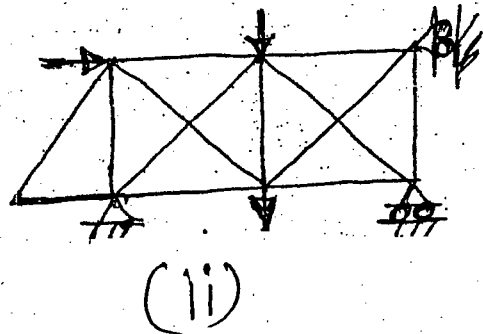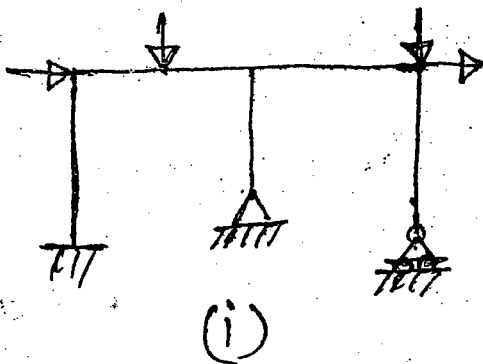
Fig. # 9

Fig. # 10

Fig. # 11

Fig. # 12

Fig. 13

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2014-2015

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

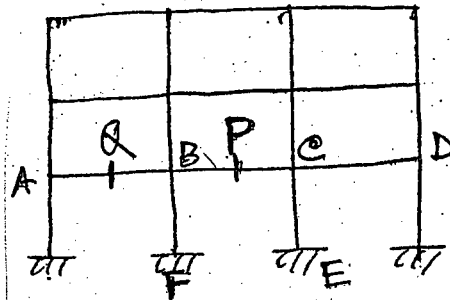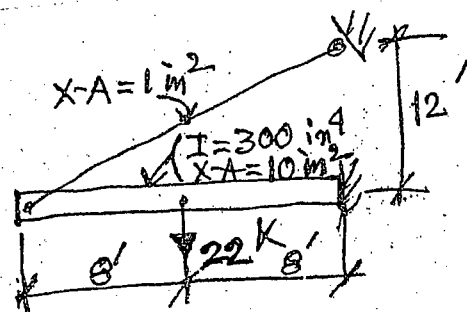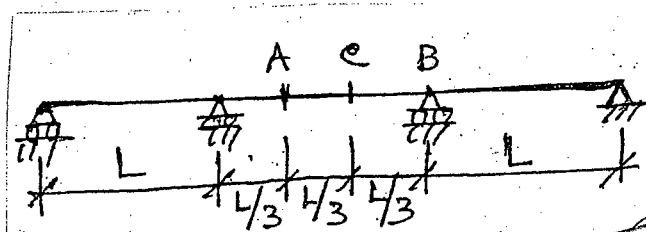## SECTION – A

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

1. (a) Show that for unidirectional flow in an unconfined aquifer between two water bodies, the water tables follows a parabolic form. Also discuss the discrepancies. **(10)**

   (b) State the assumptions underlying Theis solution for unsteady flow to a well in a confined aquifer. **(4⅓)**

   (c) A 30 cm well completely penetrates an unconfined aquifer of saturated thickness 40 m. After a long period of pumping at a constant rate of 2000 m^3/day, the drawdown in two observation wells 15 and 75 m from the pumped well were found to be 3.5 m and 1.5 m respectively. Determine the transmissivity of the aquifer and the drawdown at the well. **(9)**

2. (a) Give a comparison among a hand tubewell, a shallow tubewell and a deep tubewell in a tabular form. **(5)**

   (b) Explain with figures how an impermeable boundary in an aquifer can be located from pumping test data. **(8⅓)**

   (c) A well penetrating a confined aquifer is pumped at a constant rate of 2400 m^3/day. The time-drawdown data recorded at an observation well located 40 m from the pumped well are as follows: **(10)**

Time (min)	1.0	2.5	5	10	20	50	100	200	500	1000
Drawdown (m)	0.2	0.5	0.8	1.2	1.8	2.5	3.0	3.7	4.4	5.0

   Determine the aquifer constant S and T using Cooper-Jacob method.

3. (a) Briefly describe the cable tool method of well drilling and give advantages and disadvantages of this method. **(5)**

   (b) Write notes on (i) Placement of well screen (ii) Well development. **(8)**

   (c) Preliminary test shows that a well can yield 3000 lpm from a confined aquifer situated between 90 – 110 m below ground level. The aquifer sand has $D_{10} = 0.12$ mm $D_{50} = 0.32$ mm and $D_{60} = 0.36$ mm. (i) Determine the length of the well screen if the diameter and effective open area are 20 cm and 15% respectively, (ii) Design the gravel pack and determine the slot size of the screen. **(10⅓)**

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4. (a) What are the causes of saline water intrusion in aquifer? Derive a relation between fresh and saline waters in coastal aquifer. **(8⅓)**

(b) What are the purposes of groundwater basin investigation? Discuss the various levels of groundwater management studies. **(8)**

(c) Why are several concepts of basin yield recognized? Define them. **(7)**

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

5. (a) Define: **(8)**
   (i) Confined aquifer
   (ii) Porosity
   (iii) Leaky aquifer
   (iv) Transmissivity

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

(c) An isotropic aquifer has three different layers. Thickness of the top, middle and bottom layers are 10 m, 11 m and 9 m respectively. The hydraulic conductivities of the top, middle and bottom layers are 5 m/day, 0.06 cm/s and 2 m/day respectively. Determine the equivalent horizontal and vertical hydraulic conductivities. **(7⅓)**

6. (a) What are the agricultural sources and causes of groundwater pollution? **(8)**

(b) Describe the surface geo-physical method and seismic refraction methods for groundwater exploration. **(8)**

(c) Discuss the different components of a groundwater basin. Write short note on 'spring'. **(7⅓)**

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

(b) Discuss the sub-surface Drilling-Time log method and Resistivity logging method for investigation of groundwater. **(8)**

(c) What are the objectives of artificial recharge of groundwater? **(7⅓)**

8. (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) Discuss the 'Basin method' and 'recharge well method' for artificial recharge of groundwater. **(7⅓)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2014-2015

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) What is meant by integrated water resources management? State its basic principles. **(7)**

   (b) Briefly describe a water resources system and its functions with examples. **(8)**

   (c) Distinguish among (i) purpose, goal and objective (ii) principles, standards and procedures as applicable to water resources planning. **(8)**

   (d) Give an outline of tasks for planning an urban flood management project. **(12)**

2. (a) Briefly describe the environmental impacts of water storage and diversion projects. **(12)**

   (b) Projects A and B are to be compared in terms of their benefit-cost ratios and net benefits on a present worth basis over a 12-year period of analysis. The applicable interest rate is 8%. Project A requires 1 year for construction and provides 5 years of benefit after construction. Project B requires 2 years for construction and provides 10 years of benefits after construction. The following table shows the benefits and costs for A and B in thousand dollars. Each amount is an end-of-year value. Which is the more economic project? **(23)**

Year	Project A			Project A		
	Construction Cost	Operation Cost	Benefit	Construction Cost	Operation Cost	Benefit
1	110			120		
2		15	30	120		
3		15	50		20	45
4		15	60		20	65
5		15	80		20	75
6		15	120		20	100
7					20	120
8					20	140
9					20	160
10					20	180
11					20	210
12					20	210

WRE 415

3. (a) Give salient features of Bangladesh (i) National Water Policy (ii) National Water Management Plan (iii) National Water Act. **(12)**

(b) Briefly discuss the sequence of studies for a single engineering project. **(15)**

(c) Briefly describe the Environmental Evaluation System and Matrix methods of environmental impact assessment. **(8)**

4. (a) Write notes on (i) project benefits (ii) objectives of public participation (iii) applications of mathematical models in water resources planning and management. **(15)**

(b) Two types of crops can be grown in an irrigation project. Relevant data are given below: **(20)**

Item	Crop 1	Crop 2
Water requirement (acre-ft/acre)	5	3
Fertilizer requirement (kg/acre)	2	3
Profit (thousand Tk/acre)	10	8

Note that 16 acre-ft of water and 20 kg of fertilizer are available for the project.

(i) Formulate a linear programming model to determine the acres of land under each crop so that profit is maximized. Solve the LP model by Simplex method.

(ii) Formulate the dual model and obtain the dual solution.

SECTION – B

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

5. (a) State the responsibilities of different parties to a construction project. **(9)**

(b) "Construction Management involves Proper Assignment of Work and Appropriate Motivational Tools" – Explain. **(8)**

(c) European APE model Tandem 600 hammer has been used for pile driving at Padma Bridge Site. Comment on this selection of equipment from different considerations. **(9)**

(d) Define: (i) Supplementary Conditions, (ii) Change Orders, (iii) Liquidated Damage. **(9)**

6. (a) Suppose you have 6 months in hand for your final year thesis defense. Break down your remaining thesis works into minimum of 8 activities, where each activity has minimum of 1 month duration. Show the activities in Bar Chart and Also in AOA diagram. Hence analyse the advantages and disadvantages of Bar Chart Method. **(12)**

(b) Differentiate among different types of Engineering Drawings. **(8)**

(c) Write short notes on: (i) Causes of Construction Accident, (ii) Prequalification of Bidders, (iii) Different types of Bonds. **(15)**

WRE 415

7. (a) Briefly describe the bidding process. **(10)**

(b) A construction project has eight activities A through H. The precedence relationship is as follows: **(25)**

- A and B start at the same time
- C follows B but precedes G
- C cannot be started unless A is completed
- C precedes E
- D follows A but precedes H
- F follows E but precedes H
- G and H terminate at the same time

Task	A	B	C	D	E	F	G	H
optimistic time (days)	5	8	6	9	12	9	15	4
most likely time (days)	8	9	8	10	15	15	18	14
pessimistic time (days)	11	16	10	11	24	33	21	24

(i) Construct the network diagram,

(ii) Find the minimum time of completion and hence the critical path of the project,

(iii) What is the probability of completing the project within 60 days?

z	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00
Probability	50.00	59.87	69.15	77.34	84.13	89.44	93.32	95.99	97.72

8. (a) Compare among various types of Negotiated Contracts. **(10)**

(b) What are the three components of a construction project? Explain their interrelations. **(10)**

(c) A running factory is producing some sort of widget that required steel as a raw material. The input costs are predominantly human labor, which is 2000 BDT per day for workers, and the steel itself, which runs for 17000 BDT per ton. Factory revenue **R** is loosely modeled by the equation: **(15)**

$$R(h, s) = 200 \, h^{2/3} \, s^{1/3}$$

Here, **h** represents days of labor and **s** represents tons of steel. If the budget is 20 lakh BDT, what is the maximum possible revenue?

L-4/T-1/WRE   **Date : 31/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2014-2015

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**.

Symbols denote their usual meanings.

Assume reasonable values if any data is missing.

1. (a) Define Electromagnetic spectrum. Write down the applications of different regions of electromagnetic spectrum in water resources with respect to remote sensing. **(6)**

    (b) What is atmospheric absorption and atmospheric window of electromagnetic radiation? Explain the role of atmospheric gases in remote sensing. **(6)**

    (c) (i) Write short note on radiometric resolution and spectral resolution. **(6)**

    (ii) What is radar? What are the advantages of radar?

    (d) Define spectral response curve and critical spectral regions. How can you use the spectral signatures in landuse mapping? Explain with neat sketch. **(5⅓)**

2. (a) Write down the differences between (i) Optical satellite and radar, (ii) Sun-synchronous satellite and Geostationary satellite, (iii) active and passive remote sensing. **(6)**

    (b) Write short note on (i) solar flux density, (ii) luminosity. The sun radiates maximum energy at 0.483 μm. Determine the luminosity of sun. Given the radius of sun is 6.96×10^8 m. **(6)**

    (c) (i) What do you think would be some of the best atmospheric conditions and best time of the day for remote sensing in the visible portion of the spectrum? Justify your answer.

    (ii) What is the range resolution of a real aperture radar if the depression angle is 30° and pulse length is 0.1 microsecond? What should be the minimum distance between two distinct features on the surface if they are to be resolved as separate object in the image? **(6)**

    (d) Write down the differences between slant range and ground range. Explain the effect of slant range scale distortion and foreshortening in radar images with a neat sketches. **(5⅓)**

3. (a) If you want to monitor the soil moisture of Bangladesh for several months, what type of platform and sensor characteristics (spatial, spectral and temporal resolution) would be best for this and why? **(6)**

    (b) Write short note on a satellite that can be used for monitoring both weather and land surface. Mention the uses of different band of this satellite. **(6)**

    (c) Calculate (i) the land surface temperature and (ii) drought condition based on vegetation health index from a Landsat image acquired over Tangail in Low gain state. Following data were obtained from the image: **(11⅓)**

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Contd ... Q. No. 3(c)

Digital numbers of Thermal infrared band, Near-infrared Band and red band are 190, 205 and 50, respectively. Given $K_2 = 1282.71$ K, $K_1 = 666.09$ [W/(m^2.sr.μm)]; NDVImax = 0.83, NDVImin = 0.2; BTmax = 320 K, BTmin = 283 K; atmospheric vapor content = 1.2 g/cm^2, Upwelling atmospheric radiance = 0.5 [W/(m^2.sr.μm)], and downwelling atmospheric radiance = 0.84 [W/(m^2.sr.μm)], Day of the year = 229, earth-sun distance = 1.01244 (astronomical unit); sun elevation = 64°. Use Table 1 for information regarding satellite Landsat 7 ETM. Assume reasonable value if any data is missing.

4. (a) What types of satellite data are suitable for (i) flood delineation and (ii) landuse mapping using remote sensing? Justify your answer. Why remote sensing is a good choice for those two applications? **(6)**

(b) Write down the factors that affect the radar signal. What is polarization and how it can be useful in vegetation monitoring? **(6)**

(c) (i) Calculate soil adjusted vegetation index from the data given in Q 3(c). **(3+3)**

(ii) What are the relative advantages and disadvantages of airborne radar and spaceborne radar?

(d) If an agricultural area, with crops such as wheat and corn, became flooded, what do you think these areas might look like on a radar image? Explain the reasons for your answers based on your knowledge of how radar energy interacts with a target. **(5⅓)**

SECTION – B

There are **FOUR** questions in this section. **Q. No. 5** is compulsory and answer any **TWO** from the rest.

5. (a) Write short notes on (i) Geoid (ii) Different types of map projection (iii) UTM projection system. **(3+3+4)**

(b) Briefly explain the following types of spatial analysis with schematic diagram (i) Sliver Polygon (ii) Conflation. **(2+2)**

(c) Write short note on different types of approximate representations of a field used in GIS. **(4)**

(d) What is the function of user segment in GPS? List down the locations of control segment of GPS. **(3+3)**

(e) List down the seven methods that support spatial analysis of geometries in GIS. **(6)**

WRE 427

6. (a) Discuss the following spatial interpolation methods: **(3+3)**

    (i) Thiessen polygon (ii) Inverse Distance Weighted.

    (b) List down the name of different raster and vector data models. Draw schematic diagram of any one of the vector data models. **(3+2)**

    (c) Distinguish nominal and ratio variables in GIS. **(3)**

    (d) What are the different types of vector overlay? Write short note on each type of vector overlay. **(2+4)**

7. (a) Describe the capabilities of Database Management System (DBMS) in GIS. **(5)**

    (b) What are the different types of raster compression techniques? Briefly explain the methodology of any two of the raster compression techniques. **(2+6)**

    (c) Discuss the advantages and limitations of TIN data model? What are the uses of Topological Feature Geographic Data? **(4+3)**

8. (a) What do you mean by georeferencing? Write short note on different types of transformations in georeferencing. **(2+3)**

    (b) Why geographic information is different from other types of information? Briefly discuss about the conceptual model in data modeling with example. **(2+6)**

    (c) Distinguish multipath error and earth atmosphere error of GPS. **(3)**

    (d) Write down the classification of conical and azimuthal projection. **(4)**

Table 1.
ETM+ spectral range, post-calibration dynamic ranges, and mean exoatmospheric solar irradiance (ESUN$_\lambda$).

Band	Spectral range (μm)	Center wavelength	LMIN W/(m² sr μm)	LMAX W/(m² sr μm)	Gain (W/(m² sr μm)/DN	Bias W/(m² sr μm)	ESUN W/(m² μm)
Low gain (LPGS)							
1	0.452–0.514	0.483	-6.2	293.7	1.180709	-7.38	1997
2	0.519–0.601	0.560	-6.4	300.9	1.209843	-7.61	1812
3	0.631–0.692	0.662	-5.0	234.4	0.942520	-5.94	1533
4	0.772–0.898	0.835	-5.1	241.1	0.969291	-6.07	1039
5	1.547–1.748	1.648	-1.0	47.57	0.191220	-1.19	230.8
6	10.31–12.36	11.335	0.0	17.04	0.067087	-0.07	N/A
7	2.065–2.346	2.206	-0.35	16.54	0.066496	-0.42	84.90
PAN	0.515–0.896	0.706	-4.7	243.1	0.975591	-5.68	1362
High gain (LPGS)							
1	0.452–0.514	0.483	-6.2	191.6	0.778740	-6.98	1997
2	0.519–0.601	0.560	-6.4	196.5	0.798811	-7.20	1812
3	0.631–0.692	0.662	-5.0	152.9	0.621654	-5.62	1533
4	0.772–0.898	0.835	-5.1	157.4	0.639764	-5.74	1039
5	1.547–1.748	1.648	-1.0	31.06	0.126220	-1.13	230.8
6	10.31–12.36	11.35	3.2	12.65	0.037205	-3.16	N/A
7	2.065–2.346	2.206	-0.35	10.80	0.043898	-0.39	84.90
PAN	0.515–0.896	0.706	-4.7	158.3	0.641732	-5.34	1362

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2014-2015

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**.

Symbols have their usual meaning. Assume reasonable data, is missing.

1. (a) Describe the natural sources of irrigation water. What are the considerations to use surface water as a source for irrigation water?   **(7)**

   (b) Define Sodium Absorption Ratio (SAR). Describe type of water based on SAR and also their use in irrigation.   **(8)**

   (c) What is leaching? Derive the equation for leaching requirement?   **(7)**

   (d) Write down the various impurities in irrigation water.   **(5)**

   (e) What is the classification of irrigation water having the following characteristics: **(8)**
   concentration of Na, Ca and Mg are 23, 3.2 and 1.6 meq/l (milli-equivalent per liter) respectively and the electrical conductivity is 220 μmhos/cm at 25° C? Also find (i) what problems might arise in using on fine textured soils and (ii) what remedies do you suggest to overcome this problem?

2. (a) What are the merits and demerits of watershed canal, contour canal and side slope canal.   **(9)**

   (b) Draw a neat sketch of the cross section of an irrigation canal and identify all the salient features.   **(5)**

   (c) Define: (i) Gross Command Area (GCA), (ii) Time factor, (iii) Delta for a crop.   **(6)**

   (d) The gross command area for a distributary is 5000 hectares, 80% of which is culturable. Intensities of sugarcane and wheat crops are 25% and 50% respectively. The duties for the crops at the head of the watercourse are 730 hectares/cumec and 1800 hectares/cumec respectively. Find (i) The discharge required at the head of the watercourse, and (ii) Determine the design discharge at the outlet, assuming a time factor equal to 0.8.   **(10)**

   (e) What are the purposes of using the borrow pits and spoil banks?   **(5)**

3. (a) What are the advantages of canal lining? How would you select the suitable type of lining?   **(7)**

   (b) List up the important terms related to canal design.   **(5)**

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Contd ... Q. No. 3

(c) Design an irrigation channel with the following data: **(7)**

Discharge of the canal = 15 cumec

Permissible mean velocity = 0.80 m/sec

Bed slope = 1 in 3000

Side slope = 1 : 1

Chezy's constant, C = 44

(d) Why coefficient of rugosity and critical mean velocity are important parameters in the design of an irrigation channel. **(6)**

(e) An unlined canal giving a seepage loss of 4.3 cumec per million square of wetted area is proposed to be lined with 10 cm thick cement concrete lining, which costs Tk. 200 per 10 square meters. Given the following data (Table 1), workout the economics of lining and benefit cost ratio. **(10)**

Table 1

Annual revenue per cumec of water from all crops	Tk. 3.5 lakhs
Discharge in the channel	83.5 cumecs
Area of the channel	40.8 m^2
Wetted perimeter of the channel	18.8 m
Wetted perimeter of the lining	18.5 m
Annual maintenance cost of unlined channel per 10 square meter	Tk. 1.0

4. (a) Write down the ill-effects of water logging? What are the preventing measures against water logging? **(8)**

(b) What are the aims of an efficient irrigation management system? **(6)**

(c) Discuss different types of water rate that are used in the irrigation system. **(6)**

(d) Write down the basic assumptions to derive the equation for sub surface drainage. What are the considerations to design a surface drainage channel? **(7)**

(e) Calculate the spacing required for the water table to drop from the soil surface to a depth of 25 cm in a two day period over an area of 220 hectares from the following data: the hydraulic conductivity k = 4 cm/hr. Tile drains are to be placed 120 cm from the soil surface. The impermeable layer is 200 cm below the soil surface. **(8)**

SECTION – B

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

5. (a) Discuss why irrigation is necessary and what are the merits and demerits of irrigation. **(8)**

(b) Distinguish between (i) hygroscopic water and capillary water (ii) Gravimetric method and appearance and feel method. **(8)**

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(c) Draw typical curves of soil moisture variation with soil tension. Explain why clay soil can hold higher soil moisture compared to sandy soil for a same soil tension. **(7)**

(d) Gravimetric sampling prior to irrigation in a field gave the following data. The field capacity of the soil is 25% and the root zone depth is 1 m. Determine the net depth of irrigation. **(12)**

Sampling depth (cm)	Sampling Volume (cm^3)	Wt. of moist sample (gm)	Wt. of dry sample (gm)
0 – 25	150	215.5	191.2
25 – 50	152	227.5	204.5
50 – 75	148	230.5	208.2
75 – 100	146	235.5	210.3

6. (a) "Water-application efficiencies of 100% are not always desirable". Explain why? **(7)**

(b) Distinguish between (i) Non-weighing constant water table type and (ii) non-weighing percolation type lysimeter for measuring Evapotranspiration. **(8)**

(c) Define consumptive use and effective rainfall. List the factors affecting them. **(8)**

(d) Find ET_0 using FAO modified Penman equation for the following given data where symbols have their usual meaning. $T_{max} = 30.0°C$, $T_{min} = 11.5°C$, $R_{hu} = 25\%$, wind speed at 2 m height = 21.7 Km/day, $R_n = 288$ ly/day, C = 1.0, Weighting factor for energy term = 0.73. Assume reasonable value for any missing data. **(12)**

7. (a) Describe different components of a sprinkler irrigation system. Write down the conditions that favor sprinkler irrigation. **(7)**

(b) What are the salient features of difference between (i) border-strip flooding and uncontrolled wild flooding (ii) basin flooding and check flooding. **(8)**

(c) Distinguish between (i) sub-surface irrigation and furrow irrigation (ii) trickle irrigation and sprinkler irrigation. **(8)**

(d) A 2-ha wheat field was irrigated and the average depth of water penetration in each 0.25 ha segment was measured as: 0.85, 0.95, 1.10, 1.20, 1.10, 0.90, 0.86 and 1.03 m. The average root zone depth is 1.20 m. Calculate the water-storage and water-distribution efficiency. **(12)**

8. (a) What are the main functions of a head regulator and cross regulator? **(7)**

(b) Describe different types of falls with neat sketches. **(8)**

(c) Distinguish between (i) centrifugal pump and turbine pump and (ii) weir type escape and sluice type escape. **(8)**

(d) Define mass water content and volumetric water content and derive a relationship between them. **(7)**

(e) Explain why Rabi is the main irrigation season and favorable for high yield. **(5)**