L-4/T-1/WRE **Date : 03/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols and notations have their usual meanings.

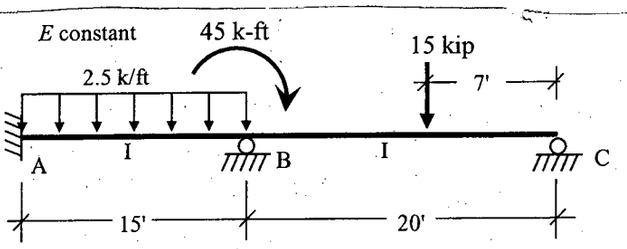
USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

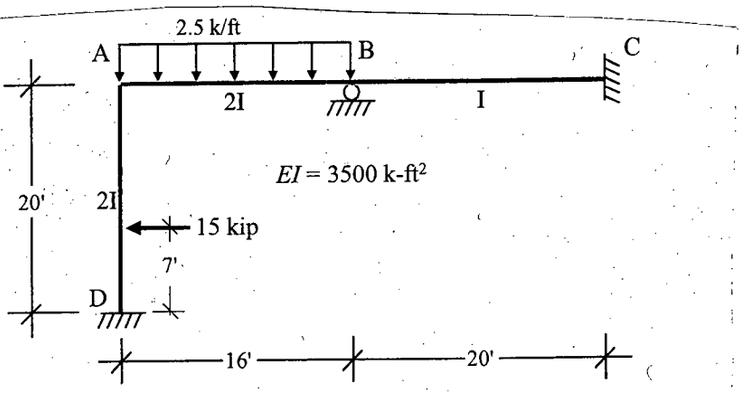
1. (a) Analyze the beam of Fig. 1 using stiffness method and draw shear force and bending moment diagrams. **(18)**

Fig.1



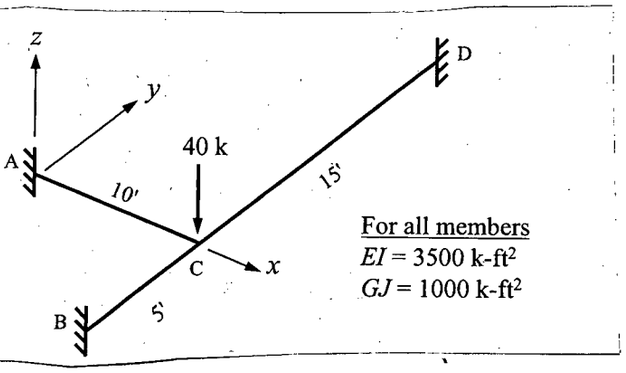
(b) Analyze the frame shown in Fig. 2 using stiffness method and determine the forces and moments developed at support D. **(17)**

Fig.2



2. (a) Analyze the plane grid of Fig.3 following stiffness method and determine the vertical deflection at C. The frame lies in horizontal X-Y plane while the load at C acts vertically downward (in-ve Z direction). **(18)**

Fig.3



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(b) For the pin connected plane truss shown in Fig. 4, (i) write down the joint coordinate matrix, member connectivity matrix, member destination vectors, global nodal load vector and global displacement vector, (ii) write down the stiffness matrices for members 1 and 2 considering them as pin-connected truss element and (iii) assemble the elements of stiffness matrices of the same members in the global stiffness matrix. Assume AE=5000 k for all members. **(17)**

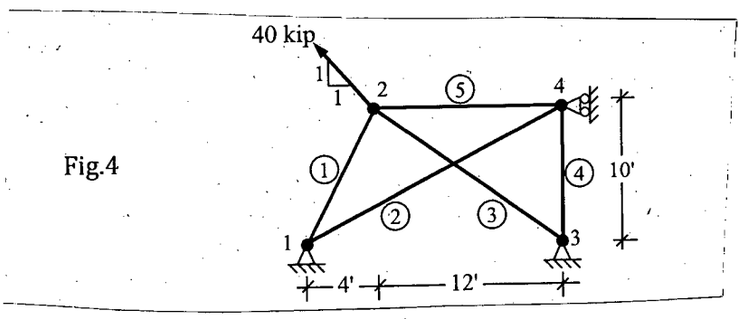

Fig.4

3. (a) Analyze the plane frame of Fig.5 using stiffness method and determine horizontal displacement at joint B. **(18)**

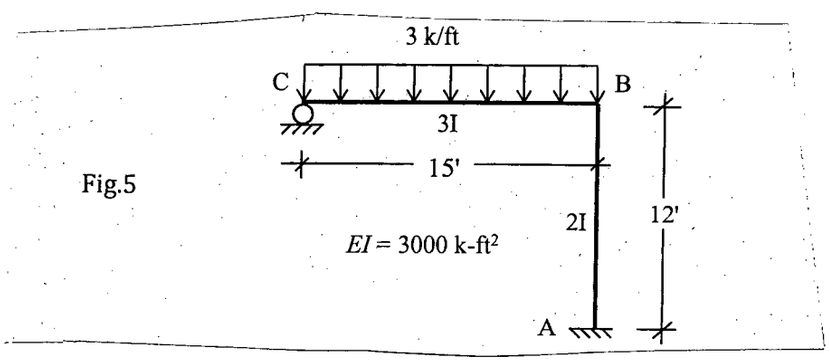

Fig.5

(b) For the continuous beam of Fig. 6, determine the ordinate of influence line for support reaction R_B at a location 5-ft to the right of support A. **(17)**

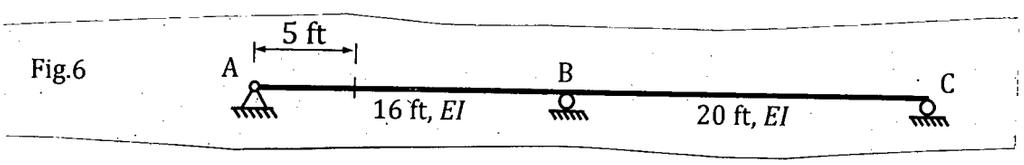

Fig.6

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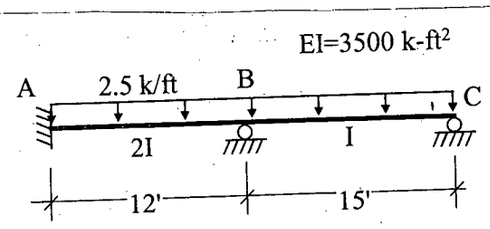
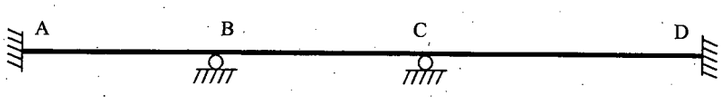
4. (a) For the loaded continuous beam shown in Fig. 7, support at B settles down by 0.25 ft. Determine the support moment and forces at all supports. **(18)**

Fig.7



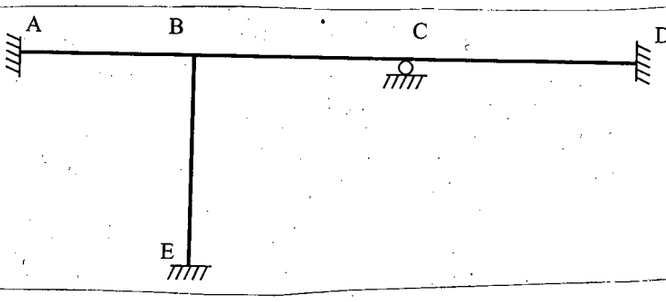
(b) (i) For the continuous beam of Fig. 8, draw qualitative shape of influence lines for M_A, R_A, R_B, M_B, V_{CL} and V_{CR}. **(12)**

Fig.8



(ii) For the plane frame of Fig. 9. Draw qualitative shape of influence lines for beam end moment M_{BA} and support horizontal reaction E_x. **(5)**

Fig.9



SECTION – B

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

Assume any reasonable value of missing data.

5. Draw the shear force and bending moment diagrams for the beam shown in Figure 10 due to the applied loads. Consider EI = 3000 k-ft² for the beam and use the moment-distribution method. **(35)**

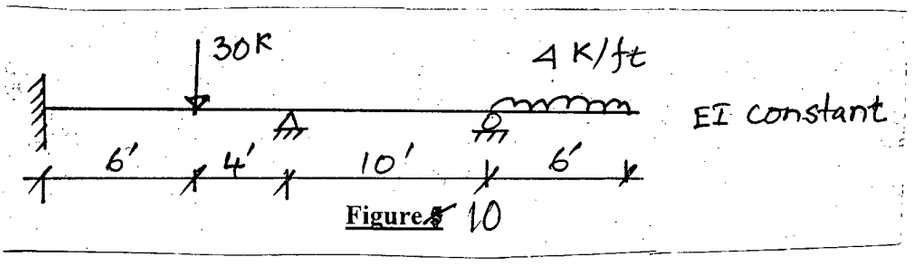


Figure 10

6. Determine the reaction and moments for the supports A and B of the frame as loaded shown in Figure11. Consider EI is constant and use the moment distribution method. **(35)**

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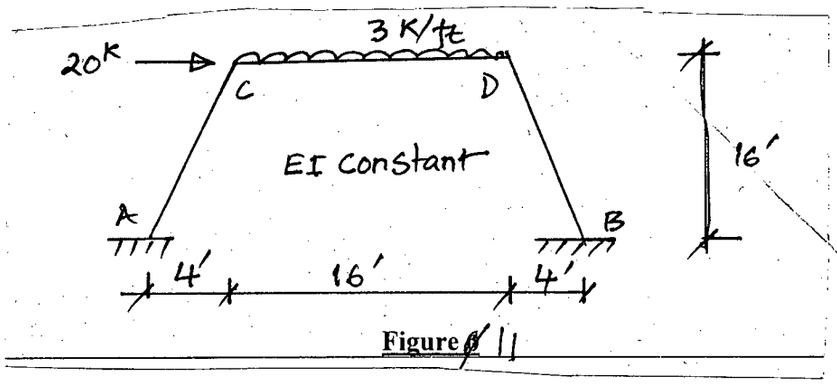

Figure 11

7. Draw the shear force and bending moment diagrams for the frame loaded as shown in Figure 12 by using the method of consistent deformations. Consider EI is constant. **(35)**

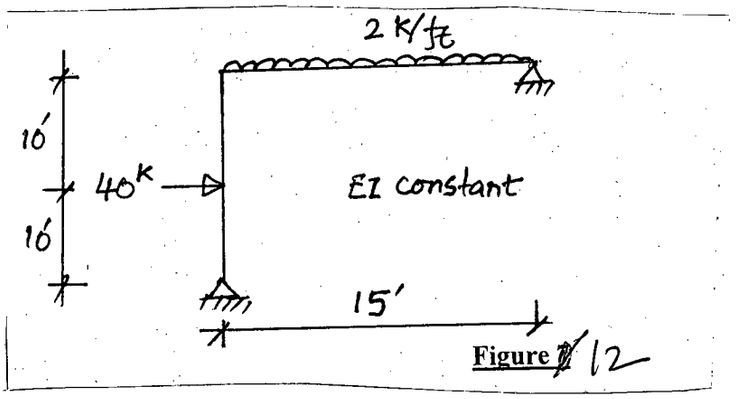

Figure 12

8. (a) Determine the support reactions and force in the member AB of the truss as shown in Figure 13(a) by using the method of consistent deformation. Consider E = 29000 ksi. **(15)**

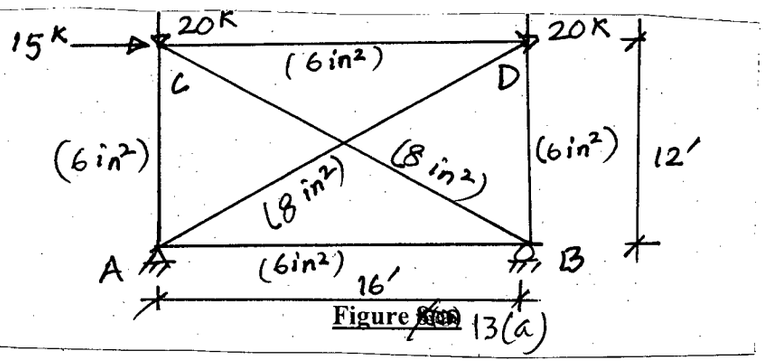

Figure 13(a)

(b) Determine the support reaction at A of the frame loaded as shown in Figure 14(b) by using the moment-distribution method. **(20)**

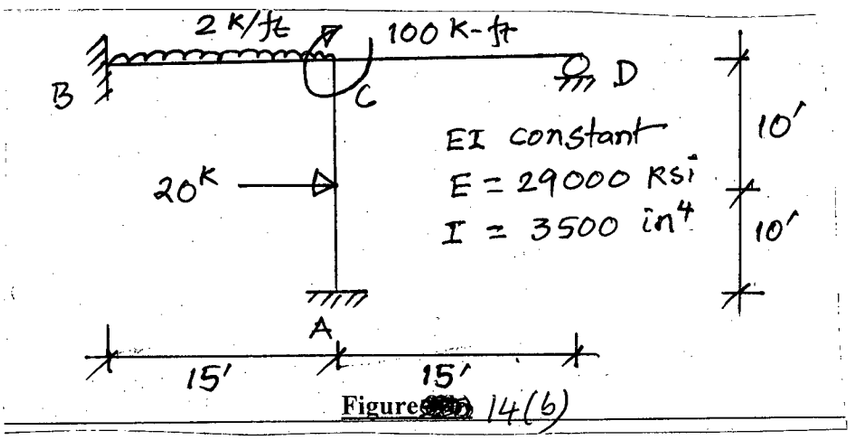

Figure 14(b)

L-4/T-1/WRE **Date : 12/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

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) What is Irrigation Engineering? Classify irrigation projects based on purpose, area coverage and procurement process of water. **(8)**

   (b) What is uncontrolled or wild flooding? What are the advantages and disadvantages of this method of irrigation? **(7)**

   (c) Differentiate between check flooding and basin flooding. **(5)**

   (d) What are the different components of sprinkler irrigation system? **(7)**

   (e) The volume of water present in a 395 cm^3 soil is 75 ml. The oven dry weight of the soil the soil is 625 gm. Calculate the soil water content on weight basis. **(8)**

2. (a) Classify the soil water that is available to plants. **(5)**

   (b) What is field capacity and permanent wilting point? Draw soil moisture condition at field capacity and permanent wilting point. **(7)**

   (c) Describe the method of measuring soil moisture using tensiometer. **(7)**

   (d) Does tensiometer reading give direct information on the field moisture content? How will you interpret the tensiometer readings? **(6)**

   (e) A sandy loam soil holds water at 130 mm/m depth between field capacity and permanent wilting point. The root depth of the crop is 30 cm and the allowable depletion of water is 37%. The daily water use by the crop is 4.5 mm/day. There are no rainfalls or ground water contribution. Determine frequency of irrigation and net depth of water application. **(10)**

3. (a) Briefly describe the methods of direct measurement of evapotranspiration. **(8)**

   (b) Compute the total consumptive use by FAO Penmen-Monteith method for the month of April when the maximum temperature 42°C, and the minimum temperature 34°C, relative humidity 36%, net radiation 14.2 MJm^{-2}. Day^{-1}, soil heat flux 0.14 MJm^{-2} Day^{-2}, wind speed 3 km/hr, slope of vapor pressure-temperature curve 0.295 kpa°C^{-1}. The given psychrometric constant is 0.067 kpa°C^{-1}. **(12)**

   (c) Which type of pump would be suitable for sprinkler type irrigation? Mention drawbacks of this pump. **(8)**

Contd P/2

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(d) Draw pump characteristic curve? Explain why 100 percent efficiency is not always desirable. **(7)**

4. (a) Define conveyance efficiency, water storage efficiency and water-application efficiency. **(8)**

(b) An area of 3.7 ha of sugarcane crop was irrigated by a stream of 75 litre/sec. for 8 hours. The irrigation was applied at 50% soil water depletion. The water holding capacity of the soil is 15 cm/m depth. A soil water estimation two days after an irrigation when the soil sampling in the field could be done showed that the sugarcane crop stored 24.6 cm water in the 92 cm root zone. Determine the water application and water storage efficiency. **(10)**

(c) What is drought? What are the main causes of drought? **(5)**

(d) What are the major impediments to efficient irrigation system management in Bangladesh? **(6)**

(e) How climate change is affecting our irrigation water management practice? **(6)**

SECTION – B

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

5. (a) A student went to polder 29 of Khulna district for a field visit. Local farmers reported that about 3360 ha area out of 5443 ha lies in the high saline zone with an electrical conductivity 2000 to 4000 μmhos/cm. As a result, crop production got hampered. What type of precautions the farmers should take to overcome this problem? Which type of crop should be grown in this area? Justify your answer. **(7)**

(b) What is the classification of irrigation water having the following characteristics: Concentration of Na, Ca and Mg are 25, 3.8 and 2.5 milli-equivalent per litre respectively and the electrical conductivity is 250 μmhos/cm at 25°C. What problem might arise in using this water in fine textured soil? What remedies do you suggest to overcome this problem? **(6+3+3=12)**

(c) Discuss the methods of land reclamation for restoring the cultivable land that have been rendered uncultivable due to salinity for a long time. **(9)**

(d) Calculate the balancing depth for the figure below having a bed width of 20 m and side slope of 1:1 in cutting and 2:1 in filling. The banks are 4 m higher than the ground level and crest width of banks is kept as 3.0 m. **(7)**

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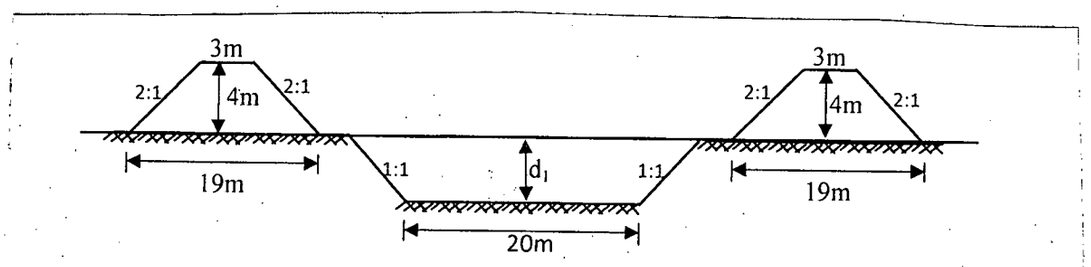

Figure for Ques. 5(d)

6. (a) With neat sketches show: (i) Absorption type channel loss (ii) Shapes of the final regime channels carrying sediments of various sizes, (iii) Tile drain with a graded filter in a previous soil. **(2.5×3=7.5)**

(b) The gross command area for a distributary is 7500 ha, 75% of which is culturable. The intensity of irrigation for Rabi season is 55% and for Kharif season is 45%. The average duty at the head of the distributary is 2150 ha/cumec for Rabi season and 850 ha/cumac for Kharif season. The kor depth and period for Rabi crop is 18 cm and 3.5 weeks respectively and for kharif crop is 25 cm and 2 weeks respectively. Assuming a time factor of 0.65, determine the design discharge at the canal outlet. **(12)**

(c) What are the advantages of canal lining? **(5)**

(d) Design an irrigation canal of trapezoidal cross-section (V:H = 1:0.5) to carry a discharge of 40 cumec, with a base width to depth ratio as 2.5. The critical velocity ratio is 1.0. Use Kutter's rugosity co-efficient 0.023 and longitudainal slope, S = 1/4000. Compare Kutter's velocity with the critical velocity. **(10.5)**

7. (a) Distinguish between: **(3×3=9)**

(i) Aqueduct and Syphon aqueduct

(ii) Weir and barrage

(iii)Wier type and regular type escape

(b) Write down the functions of the following structures in an irrigation project with sketches: **(3×3=9)**

(i) undersluices (ii) canal head regulator (iii) guide bank

(c) Define "Flexibility" and "Sensibility" of a module and derive a relationship between them. **(8)**

(d) An irrigation channel is carrying a discharge of 10 cumec. The channel is alluvial having the average bed material size of 0.15 mm. Design the channel using Lacey's theory. **(9)**

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8. (a) What are the benefits of drainage system? **(5)**

(b) Write down the various design criteria for designing open drain. **(10)**

(c) Derive an equation for spacing of a tile drain. **(10)**

(d) A tile drain has to be designed for a drainage area of 30 ha with the data given below: **(10)**

Drainage co-efficient = 4.7 cm/day

Depth of highest position of water table below land surface = 3.75 m

Depth of centre of drain below land surface = 5.25 m

Depth of impervious stratum from the land surface = 20 m

Permeability of soil = 1.25×10^{-4} m/s

Tile grade = 0.45%

Rugosity co-efficient = 0.025

Determine the size and spacing of the tile drain.

L-4/T-1/WRE **Date : 18/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

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) Define Integrated Water Resources Management (IWRM). Describe the key policy principles which a country needs to consider for effective IWRM. **(7)**

   (b) Compare between Top-down and Bottom-up approaches for water resources planning. **(7)**

   (c) State the salient features of 'Dublin Principles' for effective planning and management of water resources. **(7)**

   (d) Discuss different dimensions of IWRM. **(14)**

2. (a) Describe the generalized processes of water resources planning. **(7)**

   (b) List the task of a water resources project for flood control in Bangladesh. **(7)**

   (c) Show the key steps of SIA in a flow chart. **(7)**

   (d) Discuss the key environmental assessment processes for any water resources project. **(14)**

3. (a) Write a short note on Master Planning and Comprehensive Planning. **(7)**

   (b) List activities in 'Peoples Participation' at various stages of a project cycle. **(7)**

   (c) What is project appraisal? List the criteria for a good plan. **(7)**

   (d) Discuss the sequence of studies needed for the formation of a water resources engineering project. **(14)**

4. (a) Write a short note on Project Cost and Benefits. **(7)**

   (b) Briefly discuss the existing institutional settings for planning and management of water resources in Bangladesh. **(7)**

   (c) List the major water resources issues in different hydrological regions of Bangladesh. **(7)**

   (d) A certain project has a fixed cost of $100,000 and an annual maintenance cost of $2500 each year over a 50-year life. Benefits realized increases linearly from $4000 in the second year to $ 8000 in the 10^{th} year. The benefit for the rest of the time is $9000 per year. **(14)**

   (i) What is the project cost-benefit ratio at 4% interest?

   (ii) What is the internal rate of return if the benefit realized is constant at the rate of $7000 per year?

Contd P/2

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SECTION – B

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

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

   (b) "Construction Management involves Proper Assignment of Work and Motivational Tools to increase productivity"-Explain. **(8)**

   (c) State the considerations for selection of construction equipment. **(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. **(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)**

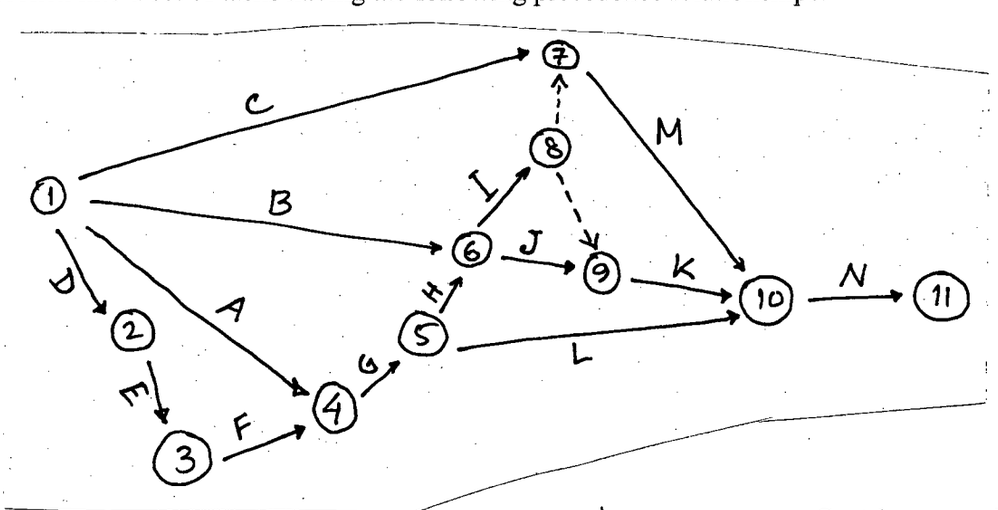
7. (a) Discuss the process of Evaluation of Tenders. **(8)**

   (b) A project consists of activities A through H whose precedence relationship is given below: **(12)**

   - 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

   Construct the Activity on Arrow network diagram.

   (c) The job of design and construction of a water resources construction project has been broken into a set of tasks having the following precedence relationships: **(15)**



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The time estimates (duration in weeks) are given below for this network diagram:

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N
optimistic time	5	0	1	0	3	1	0	1	2	2	3	3	2	1
most likely time	7	3	1	1	6	3	6	2	4	3	5	3	3	8
pessimistic time	27	6	1	8	15	5	6	15	6	4	13	3	10	9

Calculate the probability of completing the project in 42 weeks.

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) Given 3 million cubic meters (mcm) of water to be delivered in 1 mcm unit to each of three irrigation projects. Determine the optimal distribution(s) of water if all of the water is to be used. Table below shows the net benefits. **(15)**

Water delivered (mcm)	Net benefit from irrigation (10^6Tk)		
	Project 1	Project 2	Project 3
0	0	0	0
1	2	1	4
2	5	4	5
3	6	7	6

Also show the sensitivity analysis from your calculation in case of shortage of available water.

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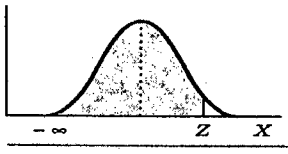
Table B1 Cumulative (Single Tail) Probabilities of the Normal Probability Distribution (Areas under the Normal Curve from $-\infty$ to Z)



Example: the area to the left of Z = 1.34 is found by following the left Z column down to 1.3 and moving right to the .04 column. At the intersection read .9099. The area to the right of Z = 1.34 is 1 − .9099 = .0901. The area between the mean (dashed line) and Z = 1.34 = .9099 − .5 = .4099.

z	00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8880
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9932	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

L-4/T-1/WRE **Date : 24/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

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) What do you understand by groundwater exploration? Briefly explain the techniques for exploring groundwater. **(10)**

   (b) Why groundwater management in necessary? Briefly explain the concept of basin management. **(13 ⅓)**

2. (a) What do you understand by surface and sub-surface investigation of groundwater? Write down the name of the methods for these investigations. **(10)**

   (b) Explain the factors responsible for groundwater fluctuations. **(13 ⅓)**

3. (a) Briefly explain the phenomenon of saline water intrusion and prove that the height of saline water below the ground level is 40 times the height of fresh water above the sea level. **(10)**

   (b) Briefly explain the sources and causes of groundwater pollution. Also write down the techniques for attenuation of this pollution. **(13 ⅓)**

4. (a) Write down the main objectives of artificial recharge of groundwater. **(5)**

   (b) What is recharge mounds? If water is flowing over a square basin of 150 m on side at a uniform rate of 5.78×10^{-6} m/s, what will be the height of the ground water recharge mound at the center of the basin after 3-moths? Assume Transmissivity as 0.60 m^2/min and storage coefficient as 0.22.Use necessary graph. **(10 ⅓)**

   (c) Write down the names of the methods of artificial recharge of groundwater and briefly explain two of them. **(8)**

SECTION – B

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

5. (a) Define: (i) Residual Drawdown (ii) Well-efficiency **(2+2=4)**

   (b) Derive the equation of transmissivity for steady radial flow in an unconfined aquifer. **(12)**

   (c) Explain "Gravel Pack plays an important role in increasing the yield of a productive well". **(7 ⅓)**

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6. (a) Differentiate between "Direct Circulation Rotary method" and "Reverse Circulation Rotary method". Which method of drilling is more suitable in your country? Justify your answer. **(9 ⅓)**

   (b) The drawdown caused by a pumping well in a confined aquifer is 1.2 m at an observation well located 10 m from the pumping well after 2 hours of pumping. When will be the same drawdown occurs at an observation well located 30 m from the pumping well? **(8)**

   (c) What do you mean by confining bed? Differentiate between various types of confining bed. **(1+5=6)**

7. (a) Briefly explain the effects of partially penetrating well in a confined aquifer. **(5 ⅓)**

   (b) Draw a neat sketch of (i) Perched water table (ii) sub-surface water distribution in a vertical soil profile. **(2+4=6)**

   (c) Preliminary test shows that a tubewell can yield 1800 lpm (litre/minute) 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. Determine: **(12)**

   (i) The length of the well screen if its diameter and effective open area are 25 cm and 15% respectively

   (ii) Design the gravel pack and determine the slot size of the screen

8. (a) Define well rehabilitation. Explain several causes and remedial measures of well rehabilitation. **(10)**

   (b) Define anisotropic aquifer. Derive the equation for equivalent horizontal hydraulic conductivity of this aquifer. **(7 ⅓)**

   (c) A constant head permeability test is performed on a soil sample with a length of 15 cm and a cross-sectional are of 10 cm^2. If 24 cm^3 of water passes through the sample in a 3 minute period when the head difference between the ends the sample is 30 cm, provide the following information: **(3+2+1=6 ⅓)**

   (i) Draw a sketch of the test set up

   (ii) What is the co-efficient of permeability of the soil?

   (iii) What type of soil would this probably be?

Use Table-

Soil Type	K(cm/s)
Clean Gravel	1-100
Coarse sand	0.01-1
Fine sand	0.001-0.01
Silty clay	0.00001-0.001
Clay	< 0.0001

Table : Typical values of hydraulic conductivity of soil

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= 3 =

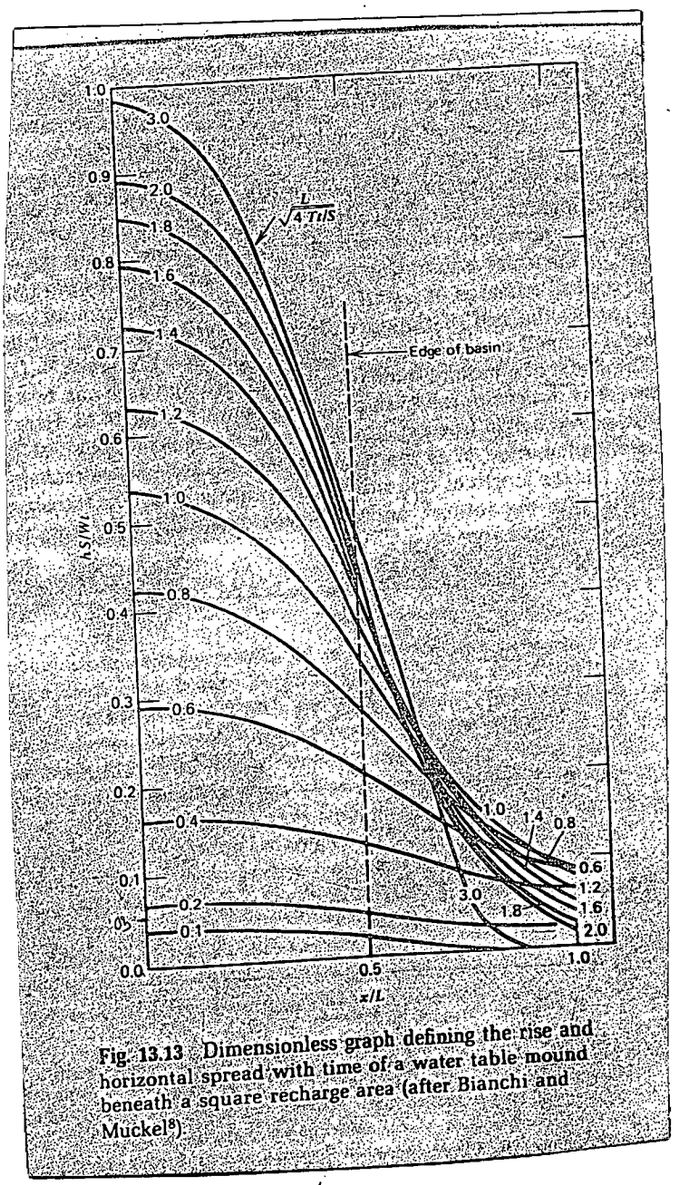

Fig. 13.13 Dimensionless graph defining the rise and horizontal spread with time of a water table mound beneath a square recharge area (after Bianchi and Muckel[8])

L-4/T-1/WRE Date : 30/09/2018

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2017-2018

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

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

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Define electromagnetic spectrum. Write down the environmental and meteorological application of remotely sensed Ultra violet, Red, Green, Near Infrared and Microwave radiation. **(6)**

   (b) What is atmospheric absorption and atmospheric window of electromagnetic radiation? Write down the sensor and ground parameters that affect radar signal. **(6)**

   (c) (i) Write short note on radiometric, temporal, spatial and spectral resolution. Define these resolution parameters for Landsat 5 satellite.

   (ii) Why rader cannot image directly beneath the antenna? **(6)**

   (d) Describe Kirchhoff's law and Wein's radiation law. Show the interaction of solar radiation with particles in the atmosphere in a neat sketch. **(5⅓)**

2. (a) What are the relative advantages and disadvantages of sensors carried on board satellites over those carried on aircraft? Explain among these two types of sensors which would be better to monitor flash flood or Bangladesh. Also mention the appropriate wavelength at which images should be acquired for this purpose. **(6)**

   (b) (i) The sun radiates maximum energy at 0.483 μm. Determine the luminosity and flux density of sun. Given the radius of Sun is 6.96×10^8 m.

   (ii) A planet is 1.5×10^8 km away from the Sun; its albedo is 0.45. What is its emission temperature? Use the data given in part (i) if necessary. **(6)**

   (c) (i) A side looking airborne radar (SLAR) is operating at a height of 10 km. Given depression angle = 25°, pulse length = 10^{-3} microsecond, wavelength = 2 cm, antenna length = 4 m. Calculate the range resolution and along track resolution of the SLAR? What should be the minimum distance between two features on the surface if they are to be resolved as separate object in the image?

   (ii) Most remote sensing techniques avoid detecting and recording wavelengths in the ultraviolet and blue portion. Explain why? **(6)**

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

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3. (a) If you want to identify and map the crop type for a certain district of Bangladesh using remote sensing, what type of platform and sensor characteristics (spatial, spectral), and temporal resolution) would be best for this and why? Explain the advantage of using remote sensing for this purpose. **(6)**

   (b) Write a short note on a weather satellite. 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 Bogra in Low gain state. Following data were obtained from the image:
   Digital numbers in Thermal infrared band, Near-infrared Band and red band are 170, 210 and 60, respectively. Given K2 = 1282.71 K, K1 = 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. **(11 ⅓)**

4. (a) What is SAR? Write down the operating principle of SAR. **(6)**

   (b) What are the advantages of radar remote sensing? Describe why the use of SAR is the only practical option for radar remote sensing from space. **(6)**

   (c) Write down the differences between (i) radiance and reflectance; (ii) Geostationary satellite and sun synchronous satellite (iii) Active and Passive remote sensing (iv) NDVI and SAVI **(6)**

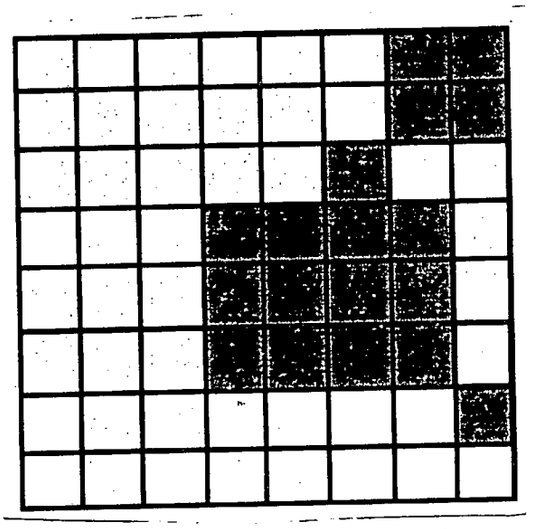
   (d) Explain the effect of leaf pigment, cell structure and water content on the spectral reflectance curve of green vegetation. Explain with a neat sketch. **(5 ⅓)**

SECTION – B

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

5. (a) What do you understand by GIS? Explain. **(5 ⅓)**

   (b) Represent the following Raster using Quad tree compression technique. **(7)**



Contd P/2

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Contd ... Q. No. 5

(c) Write down the name of the disciplines involved in GIS. **(4)**

(d) Define "Datum" based on your knowledge of GIS and Remote sensing. **(2)**

(e) Write short notes on (i) UTM projection (ii) False easing **(5)**

6. (a) Write down the application of GIS in (i) Agriculture (ii) Environmental Studies and (iii) Military sciences. **(6)**

(b) Write short note on "Geoid". **(3)**

(c) Explain different types of GPS errors. **(6)**

(d) Write short note on TIN data model. **(3)**

(e) Represent the Raster given in the question 5 using (i) Run length encoding (ii) Block encoding compression techniques. **(5⅓)**

7. (a) What do you understand by map projection? Classify map projection based on pattern of deformation. **(2+3)**

(b) What do you understand by georeferencing? **(2⅓)**

(c) Explain the stages of GIS data collection. **(5)**

(d) Explain different segments of GPS. **(6)**

(e) Discuss the following spatial interpolation methods (i) Theissan polygon (ii) Kriging. **(5)**

8. (a) Write down the classification of map projection based on geometric model of projection. **(5⅓)**

(b) Write down the advantages and disadvantages of Vector data and Raster data. **(6)**

(c) Write short notes on (i) Rubber Sheeting (ii) Noise in raster data. **(5)**

(d) What do you understand by Spatial Analysis? **(2)**

(e) Compare CAD data model and GIS data model. **(5)**

Table-1 [for Q.3(c)]

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

L7 ETM+ Sensor ($Q_{calmin} = 1$ and $Q_{calmax} = 255$)

Band	Spectral range	Center wavelength	LMIN	LMAX	Gscale	Bias	ESUN
Units	µm		W/(m²·sr·µm)	W/(m²·sr·µm)	(W/m²·sr·µm)/DN	W/(m²·sr·µm)	W/(m²·µm)
Low gain (LPCS)							
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 (LPCS)							
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	0.798819	−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	11.335	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