L-2/T-1/WRE Date: 26/10/2019

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub: **WRE 203** (Engineering Geology and Geomorphology)

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** questions.

1. (a) What is a rock cycle? Briefly explain the mechanisms of rock formation with sketches. **(15)**

   (b) Describe the characteristics features for the following mineral groups: **(20)**

   (i) Olvine
   (ii) Graphite
   (iii) Halite
   (iv) Copper

2. (a) State the five requirements of a mineral to be a mineral. **(10)**

   (b) What is metamorphism? Describe the agents of metamorphism. **(10)**

   (c) Describe the different textures of igneous rocks with examples. **(10)**

   (d) Arrange the following foliated metamorphic rocks according to temperature and pressure. (phyllite, gneiss, schist, slate). **(5)**

3. (a) Explain the following faults and folds with sketches: **(20)**

   (i) Strike Slip Faults
   (ii) Flexural flow Folds
   (iii) Dip Slip Faults
   (iv) Oblique Slip Faults

   (b) Differentiate between the following: **(15)**

   (i) Primary waves and secondary waves
   (ii) Convergent boundary and Divergent Boundary
   (iii) Epicenter and Hypocenter

4. (a) Write down the guidelines for reducing earthquake damage for individuals at public place and in moving vehicles during earthquake. **(10)**

   (b) Discuss the major causes of Earthquakes. **(5)**

   (c) Write down the geological characteristics of Bangladesh. Also describe why Bangladesh is susceptible to Earthquake. **(10)**

   (d) Describe the types of water erosion in details. **(10)**

Contd P/2

WRE 203

SECTION – B

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

5. (a) Briefly explain various types of geomorphic processes with an outline. **(10)**

   (b) What do you mean by physical weathering processes? Describe with relevant examples all the main types of physical weathering processes. **(15)**

   (c) Describe the geo-morphological characteristics of any three major rivers of Bangladesh. **(10)**

6. (a) Briefly explain various types of drainage patterns with neat sketches. **(10)**

   (b) For the stream network shown in Figure-1, calculate (i) Length ratio (ii) Drainage density (iii) Stream frequency, and (iv) Length of overland flow. Given that the length of 1^{st}, 2^{nd}, 3^{rd} and 4^{th} order streams are 25 miles, 40 miles, 160 miles and 300 miles respectively. The total area of the catchment is 800 sq. miles. **(15)**

   (c) What do you understand by glacial deposits? Briefly explain the land forms produced by glacial deposits. **(10)**

7. (a) A stream network is shown in Figure-1, designate the stream order according to strahler's method and calculate the bifurcation ratio. **(10)**

   (b) Define the parameters of a meandering river with a neat sketch. **(5)**

   (c) Explain different theories of meandering. **(10)**

   (d) Classify and explain various types of lacustrine deposits. **(10)**

8. (a) Define (i) Neck cutoff (ii) point bar, (iii) oxbow lake (iv) natural levee, and (v) thalweg line. **(5)**

   (b) A meandering river has a radius of 300 m, calculate the meander length and amplitude of the river, according to Leopold and Wolman (1980). **(10)**

   (c) Write down the characteristics of various stages of a river with neat sketches. **(10)**

   (d) Draw a typical beach profile. Briefly explain the mechanisms of aeolian depositions occurring in the coastal zones. **(10)**

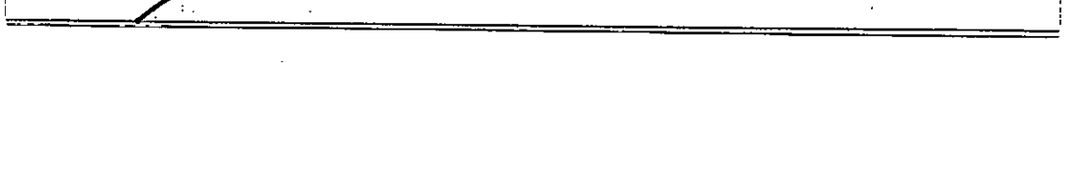


FIGURE - I

L-2/T-1/WRE **Date: 03/11/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub: **HUM 213** (Government)

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** questions.

1. (a) Define state. Discuss the differences between society and state. **(11⅓)**

   (b) What is sovereignty? Analyze different types of sovereignty with examples. **(12)**

2. (a) Discuss modern classification of government with relevant examples. **(11⅓)**

   (b) Make a comparative discussion between democracy and dictatorship. **(12)**

3. (a) Discuss the major determinants of Bangladesh foreign policy. **(11⅓)**

   (b) Describe the functions of city corporation as an urban local government institution in Bangladesh. **(12)**

4. Write short notes on any three (3) of the following: **(23⅓)**

   (a) Authoritarian dictatorship
   (b) Parliamentary government
   (c) Federal Government
   (d) Constraints of Good Governance

SECTION – B

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

5. (a) Define nationalism. Discuss the positive and negative aspects of nationalism. **(11⅓)**

   (b) What is constitution? Discuss different types of constitution with examples. **(12)**

6. (a) What is citizenship? "Rights imply duties" — explain. **(11⅓)**

   (b) Define the concept of bureaucracy. What do you know about the Ideal-type bureaucracy of Max Weber? **(12)**

7. (a) Describe the basic features of the political process of United Kingdom (UK). **(11⅓)**

   (b) Discuss the functions of six major organs of the United Nations. **(12)**

8. Write short notes on any three of the following: **(23⅓)**

   (a) Language movement of 1952
   (b) Socialism
   (c) Bangladesh constitution
   (d) Independence of judiciary.

L-2/T-1/WRE Date : 09/11/2019

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub : **MATH 231** (Differential Equations)

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) Form a differential equation for cardioide r = a(1 + cosθ). **(11)**

   (b) Solve: $\left(2\sqrt{xy}-y\right)dx-xdy=0.$ **(12)**

   (c) Solve : $(x+y)^2\left(x\frac{dy}{dx}+y\right)=xy\left(1+\frac{dy}{dx}\right).$ **(12)**

2. (a) Find the integrating factor of the differential equation **(12)**
   $\left(12y+4y^3+6x^2\right)dx+3\left(x+xy^2\right)dy=0$ and hence solve it.

   (b) Solve: $\frac{dy}{dx}+\frac{y}{x}\ln y=\frac{y}{x^2}(\ln y)^2$ **(12)**

   (c) A certain radioactive substance has a life of 38 hours. Find how long it takes for 90% of the radioactivity to be dissipated? **(11)**

3. Solve the following differential equations:

   (a) $(D^3 - 3D^2 + 4D - 2)y = e^x + \cos x.$ **(12)**

   (b) $(D^2 - 6D + 9)y = 1+x+x^2.$ **(11)**

   (c) $(2x^2D^2 - xD + 1)y = 4\sin(\ln x).$ **(12)**

4. (a) Find the regular singular points of the differential equation **(10)**
   $\left(x-x^2\right)y''+(1-5x)y'-4y=0.$

   (b) Solve the differential equation $x^2y'' + (x + x^2)y' + (x - 9)y = 0$ in series by the method of Fröbenius. **(25)**

SECTION – B

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

5. (a) From a partial differential equation by eliminating the arbitrary function ϕ form
   $\phi\left(x^2-3zy,x^2+y^2-z^2\right)=0.$ **(10)**

   (b) Apply Lagrange's auxiliary equation to solve:
   $(y-zx)p+(x+yz)q=x^2+y^2$ **(11)**

   (c) State Charpit's method. Using Charpit's method find the complete and singular integral (if it exists) of the partial differential equation $2xz - px^2 - 2qxy + pq = 0.$ **(14)**

Contd P/2

MATH 231

6. Solve the following higher order PDEs:

(a) $\left(D_x^3-4D_x^2D_y+4D_xD_y^2\right)z=4\sin(2x+y)$ **(11)**

(b) $\left(D_x+D_y-1\right)\left(D_x+2D_y-3\right)z=2x+3y$ **(12)**

(c) $\left(x^2D_x^2-4xyD_xD_y+4y^2D_y^2+6yD_y\right)z=x^3y^4$ **(12)**

7. (a) Prove that: $\frac{d}{dx}\{xJ_n(x)J_{n+1}(x)\}=x\left\{J_n^2(x)-J_{n+1}^2(x)\right\}$ **(13)**

(b) Show that: $xJ_n'(x)=nJ_n(x)-xJ_{n+1}(x)$ **(12)**

(c) Prove that: $J_{1/2}(x)=\sqrt{\frac{2}{\pi x}}(\sin x)$ **(10)**

8. (a) Use the generating function of Legendre polynomials to prove

$(n+1)P_{n+1}(x)=(2n+1)xP_n(x)-nP_{n-1}(x)$. **(10)**

(b) Show that $\int_{-1}^{1}\left(x^2-1\right)P_{n+1}(x)P_n'(x)dx=\frac{2n(n+1)}{(2n+1)(2n+3)}$. **(10)**

(c) Prove the Rodrigue's formula for Legendre's polynomial

$P_n(x)=\frac{1}{2^n(n!)}\frac{d^n}{dx^n}\left(x^2-1\right)^n$. **(15)**

L-2/T-1/WRE **Date: 20/10/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub: **CE 221** (Mechanics of Solids I)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

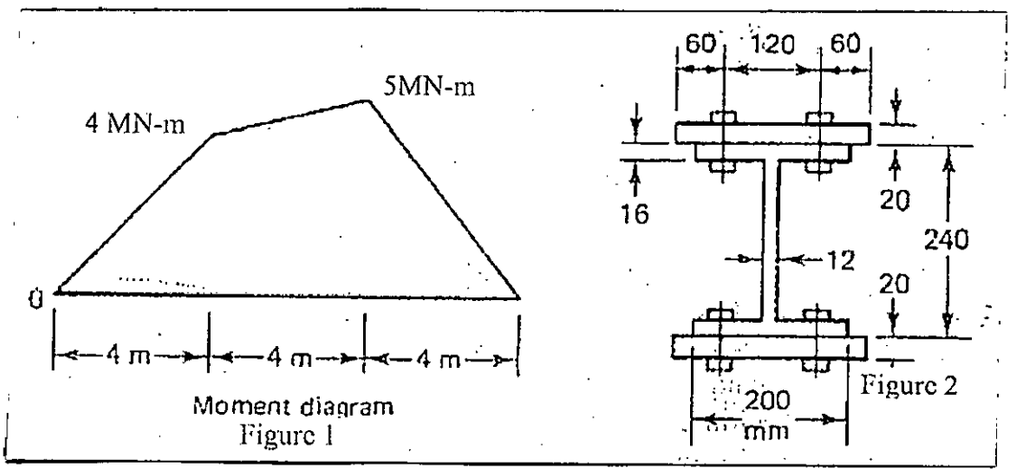
USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Assume reasonable values for missing data.

1. (a) A beam is loaded so that the moment diagram varies as shown in Figure 1. For the cross section shown in Figure 2, determine the bolt spacing for the critical region of the span. The bolts are arranged in pairs, and the allowable shear force per bolt is 150 kN. All the dimensions in Figure 2 are in mm. **(20)**



Moment diagram
Figure 1

Figure 2

(b) A box beam has the cross section shown in the figure (Figure 3). Calculate shear stresses at several horizontal sections when the beam bending moment changes along the beam at the rate of 500 kN-m/m and plot the results. The dimensions are in mm unit. **(15)**

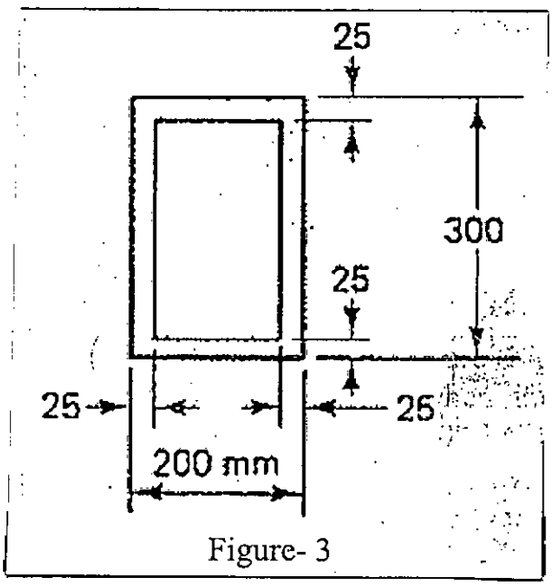


Figure- 3

Contd P/2

CE 221

2. (a) using the force method, determine the reaction for the circular stepped shaft shown in Figure 4. The applied torques are T_1 = 700 lb-in, T_2 = 500 lb-in and T_3 = 100 lb-in. The shaft diameters are d_1 = 2.5 in. and d_2 = 2.0 in. Let E = 10×10^3 ksi and Poisson's Ratio is $\frac{1}{3}$. **(25)**

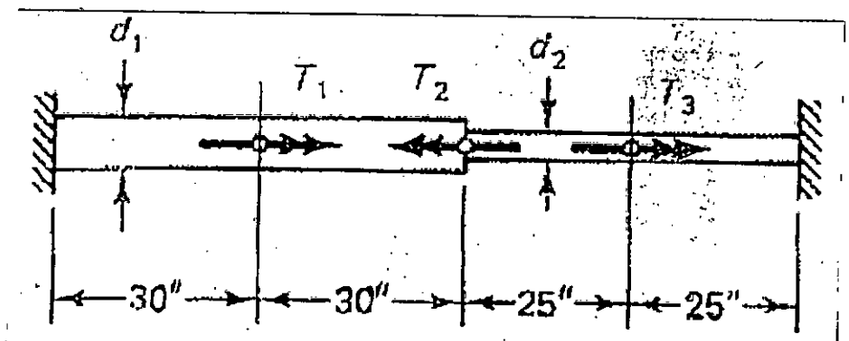


Figure 4

(b) Plot the angle of twist diagram for the shaft along its length. **(10)**

3. (a) Specifications of the American Water Works Association provide that a 36-inch diameter Class A (Wall thickness 1.15 inches) cast iron pipe must withstand a hydrostatic pressure of 200 psi. What circumferential unit stress does this pressure cause? **(8)**

(b) A fire extinguisher has a copper tank holding 3 gallon. The inside diameter is 8 in. and the thickness of the shell of the tank is 0.15 in. The extinguisher was tested with a water pressure of 400 psi. What stress did the pressure cause in the shell of the tank? **(10)**

(c) Consider a closed cylindrical steel pressure vessel, as shown in Figure 5. The radius of the cylinder is 1000 mm and its wall thickness is 12 mm. Determine the hoop and the longitudinal stresses in the cylindrical wall caused by an internal pressure of 0.9 MPa and calculate the change in diameter of the cylinder caused by pressurization. Let E = 200 GPa and Poisson's ratio = 0.25. Assume that $r_i = r_o = r$. **(17)**

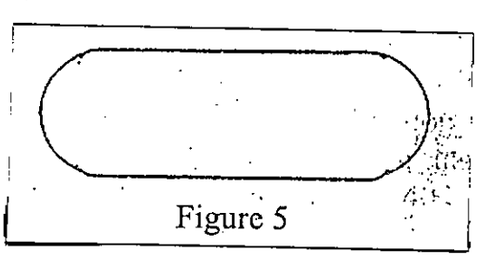


Figure 5

Contd P/3

CE 221

4. (a) Draw Axial Force Diagram of the following elastic steel beam (Figure 6). Determine the relative displacement of point D from point A for the elastic steel bar of variable cross sections caused by the application of concentrated forces. Areas A_{AB} = 2500 mm^2, A_{BC} = 1500 mm^2, A_{CE} = 750 mm^2. Modulus of Elasticity, E = 200 GPa. **(18)**

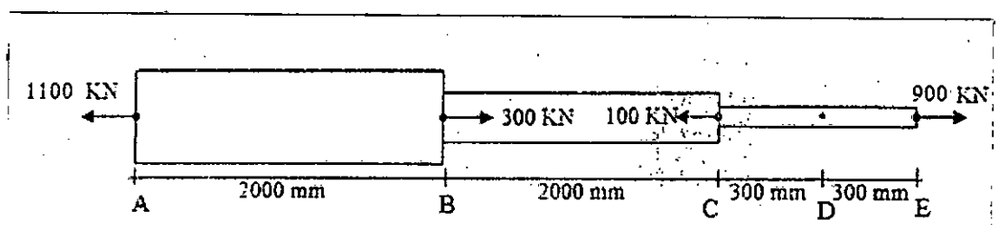


Figure 6

(b) Two steel wires with well designed attachments and a joint are subjected to an external force of 850 N, as shown in the figure (Figure 7). The diameter of wire AB is 3.0 mm and that of wire BC is 3.52 mm. Determine the stresses in the wires caused by the applied vertical force. Dimensions are in mm unit. **(17)**

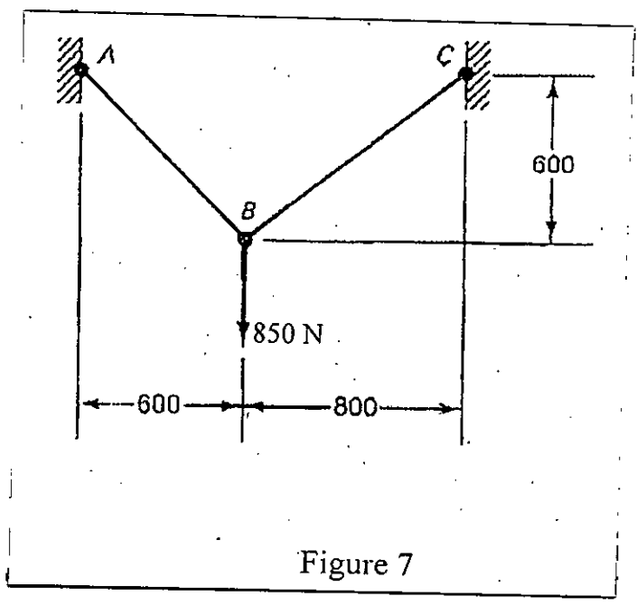


Figure 7

SECTION – B

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

5. Determine the location of the shear center for the beam having the cross-sectional dimensions shown in Fig. 8. All members are to be considered as thin walled and calculation should be based on the center line dimension. **(26¼)**

Contd P/4

CE 221

6. Draw bending moment and shear force diagrams for the beam with loads shown in Fig. 9. **(26¼)**

7. Draw bending moment and shear force diagram for the beam with loads shown in Fig. 10. **(26¼)**

8. A small steel T beam is used in an inverted position to span 400 mm. If due to the application of the three forces shown in the Fig. 11, the longitudinal gage a A register a compressive strain of 50×10^{-5}, what is the value of 'P'. E = 200 GPa. All dimensions shown in the figure are in mm. **(26¼)**

9. Determine the shortening of steel tubular spreader bar AB due to application of tensile forces at C and D as shown in Fig. 12. The cross-sectional area of the tube is 100 mm^2. Let, E = 200 GPa. **(26¼)**

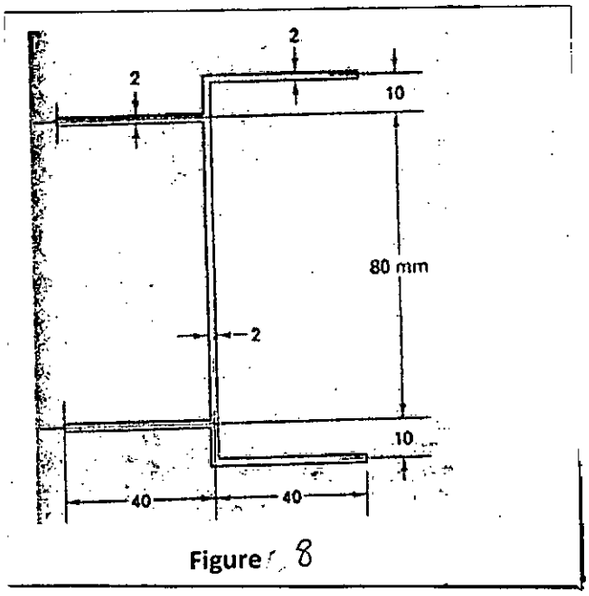


Figure 8

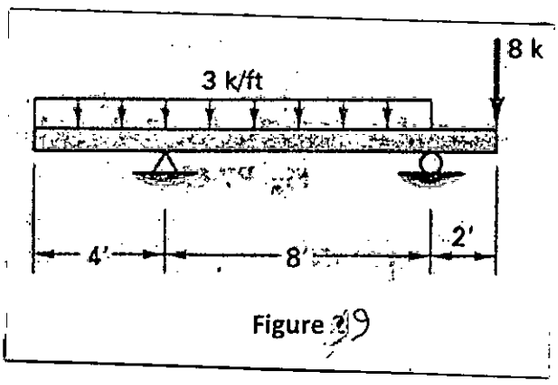


Figure 9

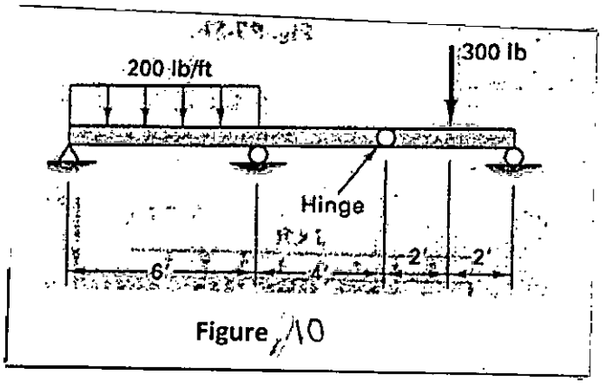


Figure 10

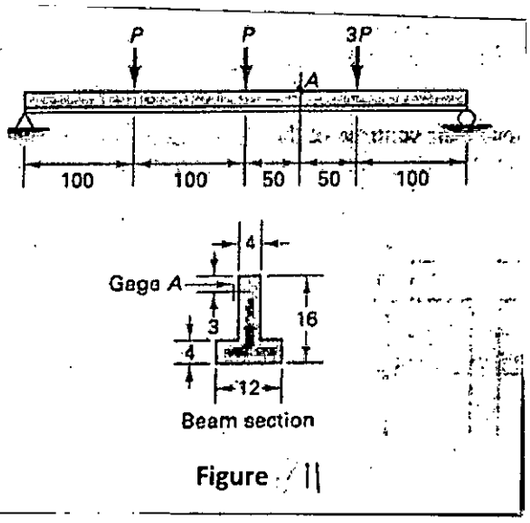


Figure 11

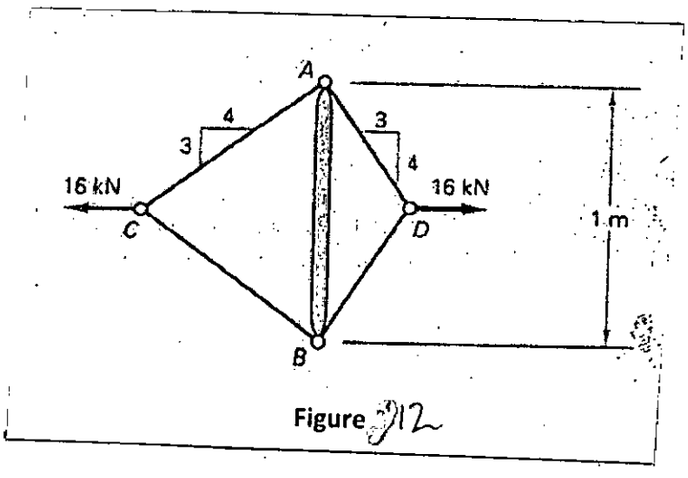


Figure 12

L-2/T-1/WRE **Date : 30/10/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub : **CE 291** (Engineering Materials)

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**.

Assume reasonable value for any missing data.

1. (a) Draw the strain response diagram under the loading-unloading sequence shown in **Figure 1**, assuming the material is: (i) Elastic, (ii) Plastic, (iii) Elasto- Plastic, and (iv) Elasto- Visco- Plastic. **(25)**

   (b) What is a fiber-reinforced polymer (FRP)? What are the common fiber and polymer matrix used in FRP? Draw typical tensile stress-strain characteristics of the fiber, polymer matrix, and FRP composite. **(2+4+4=10)**

2. (a) What are the major differences between RCC and ferrocement? What are the common types of wire mesh used in ferrocement? Draw a typical section of ferrocement. **(5+4+4=13)**

   (b) What is spalling of concrete? Describe with neat sketches of how ferrocement can be used to repair spalling of a floor slab. **(2+10=12)**

   (c) Describe with neat sketches the characteristics of (i) Elastic strain, (ii) plastic strain, and (iii) viscous strain. Give example of these materials among the common civil engineering materials. **(7+3=10)**

3. (a) What are the functions of C_3A, C_2A, C_2S and C_4AF in cement? **(10)**

   (b) What is the hydration of cement? Draw the qualitative diagram of the rate of heat evolution during hydration of cement. **(2+5=7)**

   (c) What is the differences between the initial and final setting time of cement? What is the function of gypsum on controlling the setting time of cement? **(4+4=8)**

   (d) What are the specialties of the (i) rapid hardening and (ii) low heat cement over OPC in terms of ingredients and usages? **(5+5=10)**

4. (a) Write short notes on the following: (i) Calcination, (ii) Slaking of lime, (iii) Efflorescence of brick, (iv) Frog Mark in brick, (v) Hoffman's Kiln. **(5×2=10)**

   (b) Write down the characteristics of a good brick. **(10)**

   (c) What are the common methods of seasoning of timber? What are the differences between plywood and fiberboard? **(5+5=10)**

   (d) Write the functions of different constituents of glass. **(5)**

Contd P/2

CE 291

SECTION - B

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

5. (a) Design compressive strength of an underground water reservoir tank is 3500 psi. Required slump value for concrete is 50-100 mm. What would be the preliminary mix properties of concrete for this design strength? The dimension (Length × Width × Depth) of the tank is 12'×8'×6', thickness of each wall is 6 inch. Estimate the cement (bag), fine aggregate (cft), and coarse aggregate (cft) required for construction of the tank. Use the following material properties in your calculation. Assume reasonable values for missing data. Use attached tables (Table-4) where necessary. **(25)**

Cement: Ordinary Portland cement, specific gravity = 3.0

Coarse Aggregate:

Maximum Size: $\frac{3}{4}$ inch

Absorption Capacity: 2.5%

Moisture Content: 1.5%

Bulk Specific Gravity (OD): 2.6

Unit Weight of Coarse Aggregate: 1500 kg/m^3

Loose Dry Density: 1300 kg/m^3

Fine Aggregate:

Fineness Modulus: 2.56

Absorption Capacity: 2.5%

Moisture Content: 4%

Bulk Specific Gravity (OD): 2.6

Loose Dry Density: 1400 kg/m^3

(b) How are compressive strength of concrete, water-cement ratio and workability related? **(10)**

6. (a) Design a concrete mix by the 'Minimum Voids Method' from the following data: Voids in coarse aggregate = 30%; Voids in fine aggregate = 25%. Allowances for cement = 12%; Allowances for fine aggregate = 13%. Assume reasonable value for missing data, if any. Calculate the amount of ingredients (cement (kg), sand (cft), coarse aggregate (cft), water (L) required to cast 9 cylinder samples (4 inch dia., 8 inch height) as per your estimated mix proportion. **(20)**

(b) Define workability of concrete. How can you measure workability of fresh concrete by slump test? Show with neat sketches. **(10)**

(c) What are the basic factors that influence choice of concrete mix design? **(5)**

Contd P/3

CE 291

7. (a) Gradation curve of a sand sample is obtained through sieve analysis. The effective size (D_{10}), mean diameter (D_{50}) and D_{90} of the sample are 0.1 mm, 0.7 mm, and 2 mm respectively. The coefficient of uniformity (C_u), and coefficient of curvature (C_z) of the sample is 4 and 1, respectively. All particles pass through the No. 4 (4.76 mm) sieve. Draw the gradation curve of the sand sample in a graph paper and calculate fineness modulus (FM). **(20)**

(b) How does bulking of sand occur? What is its importance in concrete mix design? **(8)**

(c) The mass of a sand sample at ambient condition is 600 gm and oven dry mass is 590 gm. If the absorption capacity is 2.6%, do we need to add water to reach at SSD condition? If so, how much water needs to be added? **(7)**

8. (a) Estimate the mix ratio of Aggregates 1, 2, 3, and 4 to obtain the aggregate blend to meet the specification. Also determine the % passing for the combined aggregate in each sieve and the FM of the combined aggregate. **(25)**

Sieve Size		% passing				Specification
mm	inch	Aggregate 01	Aggregate 02	Aggregate 03	Aggregate 04	% Passing
175	7	100	-	-	-	
150	6	96	-	-	-	
100	4	30	100	-	-	
75	3	10	90	-	-	62
50	2	2	25	100	-	
37.5	1.5	0	10	90	-	30
25	1	0	5	40	100	
19	3/4	0	0	7	93	10
9.5	3/8	0	0	4	40	
4.76	No. 4	0	0	0	4	

(b) What are the reasons behind blending of aggregate? **(5)**

(c) Why does the compressive strength of concrete vary with size of the aggregate? **(5)**

Contd.—P/4

Tables for Question No. 5(a)

Table 1: ACI recommended w/c ratio for normal strength concrete

Mean target strength		
psi	MPa	w/c ratio
6000	41	0.41
5000	34	0.48
4000	28	0.57
3000	21	0.68
2000	14	0.82

Table 2: ACI recommended dry rodded bulk volume of coarse aggregate per unit volume of concrete

max size of agg.	FM of fine aggregate			
mm	2.40	2.60	2.80	3.00
9.5	0.50	0.48	0.46	0.44
12.5	0.59	0.57	0.55	0.53
19	0.66	0.64	0.62	0.60
25	0.71	0.69	0.67	0.65
37.5	0.75	0.73	0.71	0.69
50	0.78	0.76	0.74	0.72
75	0.82	0.80	0.78	0.76
150	0.87	0.85	0.83	0.81

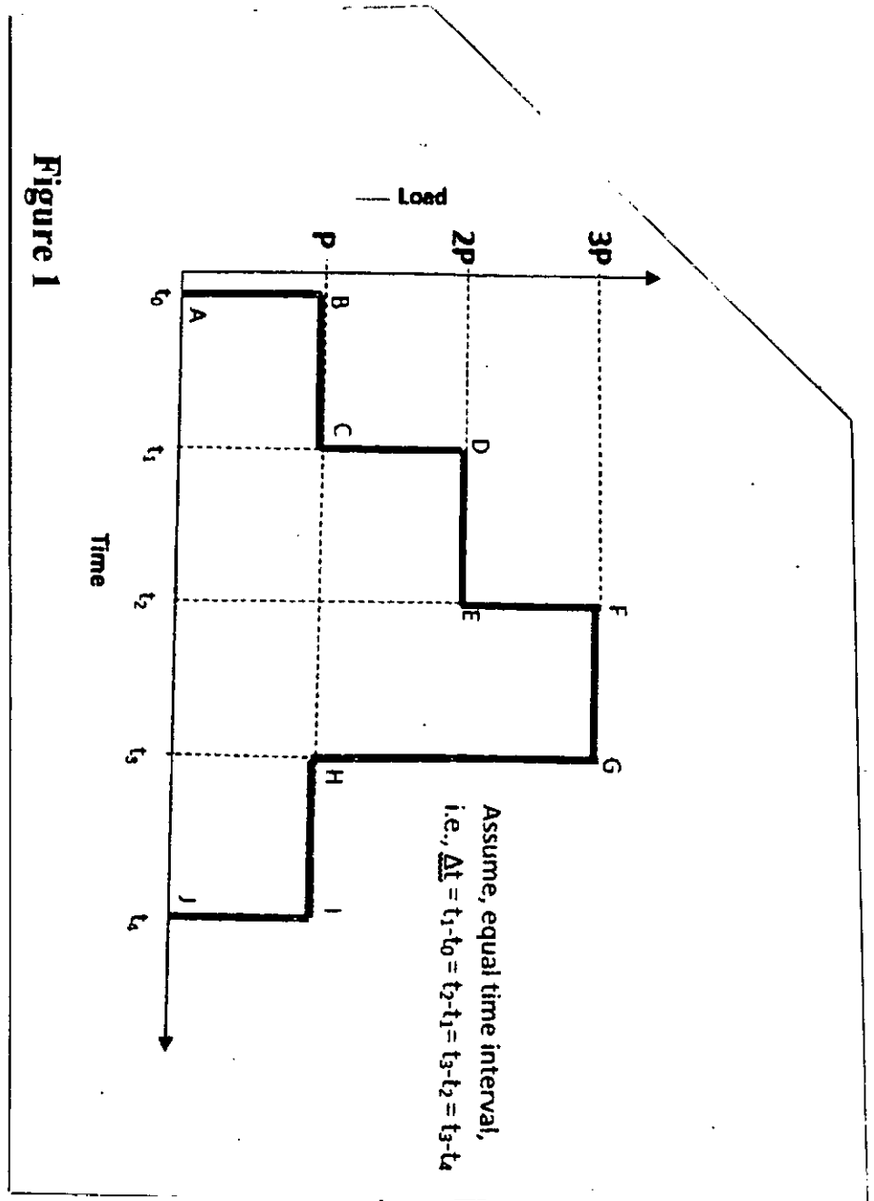
Table 3: ACI recommended mixing water content for 1 m^3 fresh concrete

Max size of aggregate (mm) →	10	12.5	20	25	40	50	70	150
Slump value (mm) ↓	Amount of mixing water in kg per 1 m^3 concrete							
25 to 50	207	199	190	179	166	154	130	113
75 to 100	228	216	205	193	181	169	145	124
150 to 175	243	228	216	202	190	178	160	-
Entrapped air (%)	3	2.5	2	1.5	1	0.5	0.3	0.2

Table 4: **REQUIRED AVERAGE COMPRESSIVE STRENGTH WHEN DATA ARE NOT AVAILABLE TO ESTABLISH A STANDARD DEVIATION**

Specified compressive strength, f_c', psi	Required average compressive strength, f_{cr}', psi
Less than 3000	$f_c' + 1000$
3000 to 5000	$f_c' + 1200$
Over 5000	$1.10f_c' + 700$

Figure 1



CE 291

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