BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1   B. Sc. Engineering Examinations 2014-2015

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

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

Assume reasonable value of missing data.

1. (a) Define with sketch four types of internal resultant forces such as normal force, shear force, torsional moment and bending moment in a cross-section of a member.   **(12 ¼)**

    (b) Draw a typical stress-strain diagram of a ductile material and define the term yield strength, ultimate strength, modulus of elasticity and resilience.   **(14)**

2. Draw shear force and bending moment diagrams for the beam loaded as shown in Figure 1.   **(26 ¼)**

3. (a) Draw axial force, shear force and bending moment diagrams for the planar frame loaded as shown in Figure 2.   **(10 ¼)**

    (b) A composite beam of cross-sectional dimension 200 × 300 mm is shown in Figure 3. The upper 200-by 280-mm part is wood, E_w = 10 GPa; the lower 20-by-200-mm strap is steel, E_s = 200 GPa. If this beam is subjected to a bending moment of 60 kN.m around horizontal axis, what are the maximum stresses in the steel and wood?   **(16)**

4. Determine the maximum tensile and compressive stresses developed in the beam loaded as shown in Figure 4(a). The cross-section is a T as shown in Figure 4(b).   **(26 ¼)**

5. A steel bar 3 inch wide and 1 inch thick is 3 ft long as shown in Figure 5. On the application of force P, the bar width becomes narrower by 0.6×10^{-3} inch. Estimate the magnitude of applied force P and the axial elongation of the bar. Given, $E = 30 \times 10^3$ ksi and $v = 0.25$.   **(26 ¼)**

CE 221

SECTION – B

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

6. (a) The A-36 circular steel bar having diameter of 0.5 inch shown in Figure 6 is constrained to just fit between two fixed supports when $T_1 = 35°C$. If the temperature is dropped to $10°C$, determine the average normal thermal stress developed in the bar. Given: $\alpha = 12 \times 10^{-6}/°C$. **(16¼)**

(b) The tank of a cylindrical air compressor is subjected to an internal pressure of 700 kPa. If the outer diameter of the tank is 600 mm and the wall thickness is 7 mm, determine the stress components acting at a point of the wall. **(10)**

7. A steel wide-flange beam has the dimensions shown in Figure 7 is subjected to a shear force of V = 100 kip. **(18¼+8)**

    (i) plot the shear stress distribution acting over the beam's cross-sectional area

    (ii) determine the shear force resisted by the web

8. The double T-beam is fabricated by welding the three plates together as shown in Figure 8. If the weld can resist a shear stress $\tau_{allow} = 21$ ksi, determine the maximum shear V that can be applied to the beam. **(26¼)**

9. A steel shaft AC is subjected to torques $T_1 = 250$ N-m and T_2 100 N-m as shown in Figure 9. Segment AB is solid circular cross-section as shown in Sec a-a and segment BC is thin-walled tubular section as shown in Sec b-b. Determine the maximum stresses at segments AB and BC and angle of twist at point C. Given: G = 75 GPa. **(26¼)**

10. (a) A solid circular shaft having diameter of 50 mm is to be used to transmit power of 80 kW. Determine the frequency of rotation, f of the shaft so that shear stress will not exceed 45 MPa. Given: T = 159* kW/f   (N-m) **(12¼)**

(b) The steel rod has a square cross section of 20 mm by 20 mm. If it is 7 m long, determine the torque T that is required to rotate one end relative to the other end by 90°. Given: G = 75 GPa, $\tau_{allow} = 300$ MPa. **(14)**
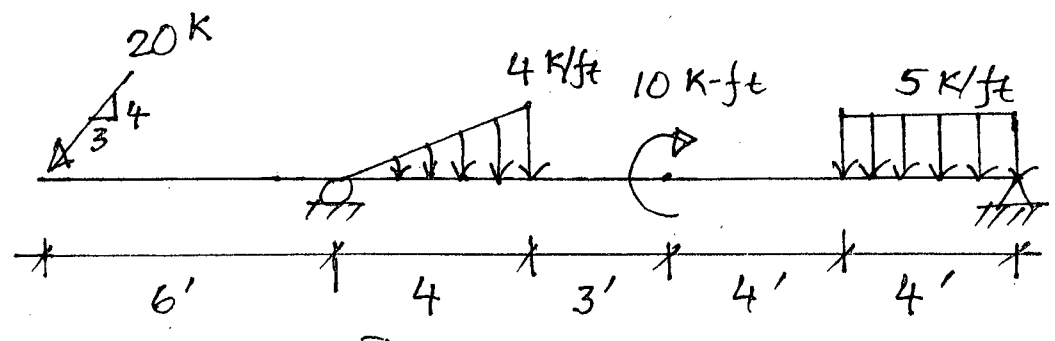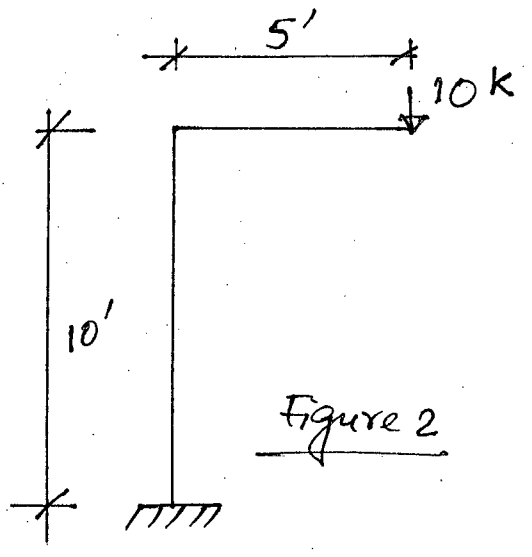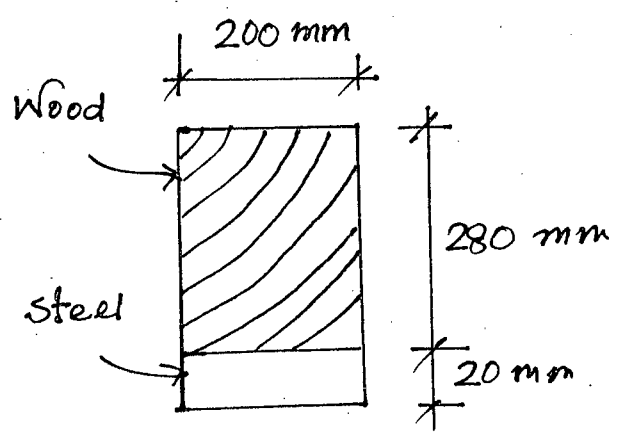

Figure 1

Figure 2

Figure 3
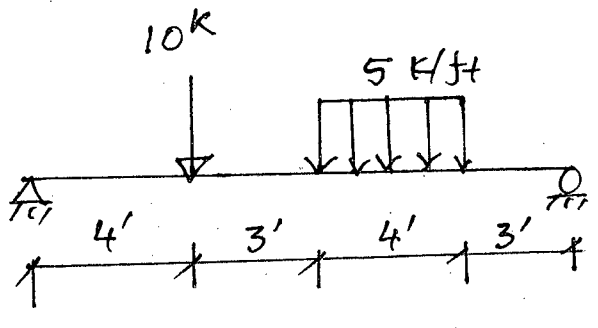
Figure 4 (a)

Figure 4 (b)

Figure 5
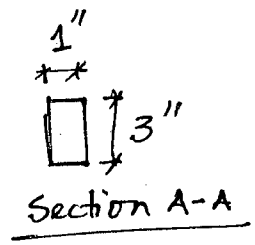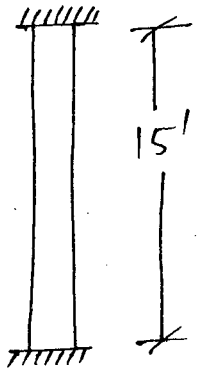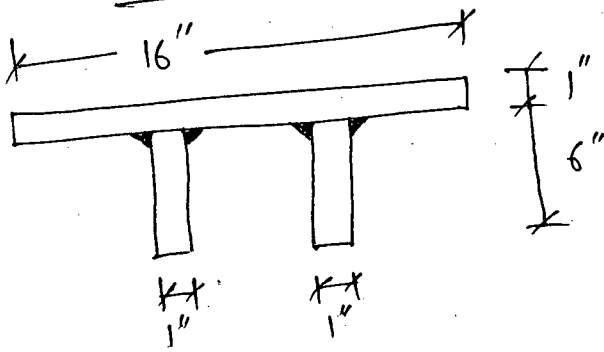
Section A-A

Figure - 6

Figure - 7

Figure - 8
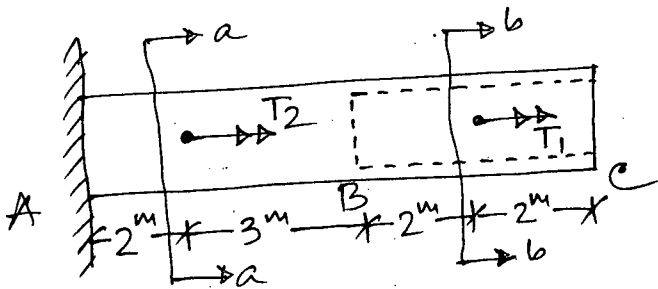
Figure - 9
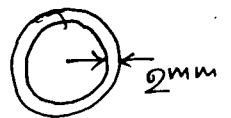
section a-a   section b-b

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1   B. Sc. Engineering Examinations 2014-2015

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

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

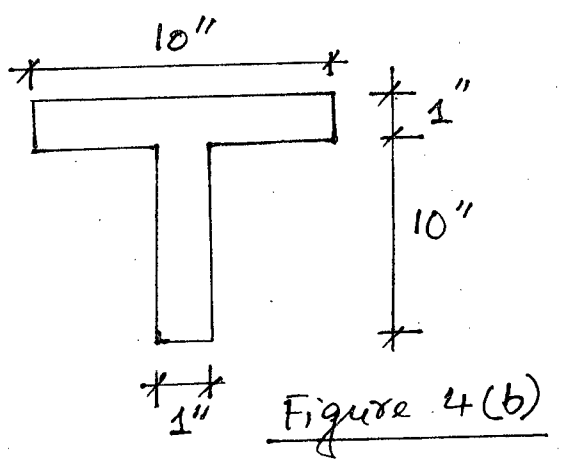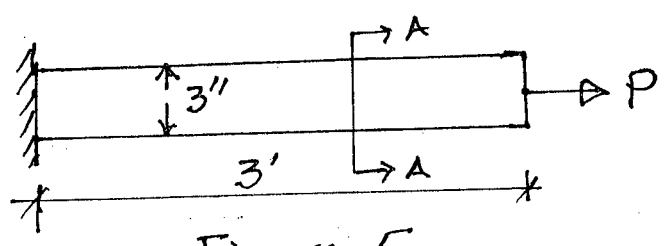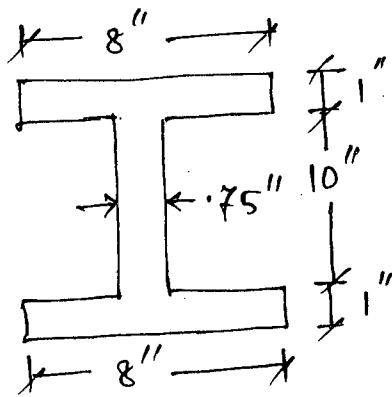## SECTION – A

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

1. (a) Define geomorphology and geomorphic cycle.   **(5)**

    (b) Describe Physical Weathering process and Chemical Weathering process.   **(13)**

    (c) Briefly describe different types of alluvial streams.   **(12)**

    (d) What do you mean by alluvial fans? Write the features of the alluvial fans.   **(5)**

2. (a) Write short notes on (i) Backswamp deposits (ii) River deltas (iii) Swamp deposits
    (iv) Natural levees (v) Barchan   **(20)**

    (b) What do you understand by Aeolian deposits? How transportation of sediments and
    erosion occurs by wind?   **(10)**

    (c) Briefly describe thickness and textural characteristics of Aeolian deposits.   **(5)**

3. (a) Briefly describe summer and winter profile of coastal deposition.   **(5)**

    (b) Write short notes on (i) Moraines (ii) kames and kettle holes (iii) Ice sheet (iv) Spit
    (v) Barrier.   **(20)**

    (c) Describe the river flood plains.   **(10)**

4. (a) Define Parallel, Trellised and Herringbone drainage pattern.   **(9)**

    (b) Compute Form Factor and Compactness Coefficient for the catchment shown in the
    Fig. 1.   **(6)**

    (c) Make stream ordering according to Horton's method and Strahler's method of stream
    order for the stream network showing in Fig. 2. Calculate (i) Bifurcation ratio (ii)
    Drainage density (iii) Stream frequency for the stream network using Horton's method
    of stream order. Given that the mean length of 1st, 2nd, 3rd and 4th order streams are 5
    miles, 10 miles, 100 miles and 175 miles respectively.   **(20)**

WRE 203

SECTION – B

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

5. (a) What is rock cycle? Briefly describe rock cycle and the mechanism of rock formation. **(15)**

    (b) Define rocks and minerals. Write down the physical properties of minerals. **(15)**

    (c) Write down the name of mineral groups. **(5)**

6. (a) What do you understand by folds, domes and basins? Briefly describe different types of folds with neat sketches. **(12)**

    (b) Define erosional and depositional process. Write down the names of different erosional and depositional landforms. **(8)**

    (c) Briefly describe different types of landforms developed by wind with examples. **(15)**

7. (a) Write down the economic importance and uses of at least 10 minerals. **(20)**

    (b) Write short note on silica. **(5)**

    (c) Define strike, dip angle, normal fault, reverse fault and thrust fault with neat sketches. **(10)**

8. (a) What is earthquake? Write down the causes and effects of earthquake. **(10)**

    (b) Write short note on P-Wave and S-wave. **(8)**

    (c) Write down the earthquake safety rules. **(10)**

    (d) Briefly describe the geological characteristics of Bangladesh. **(7)**
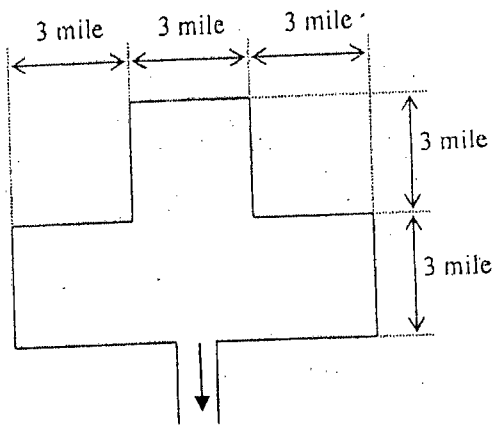

Fig. 1 for Q.No. 4 (b)

Fig. 2 for Q. No. 4(c)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1   B. Sc. Engineering Examinations 2014-2015

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.

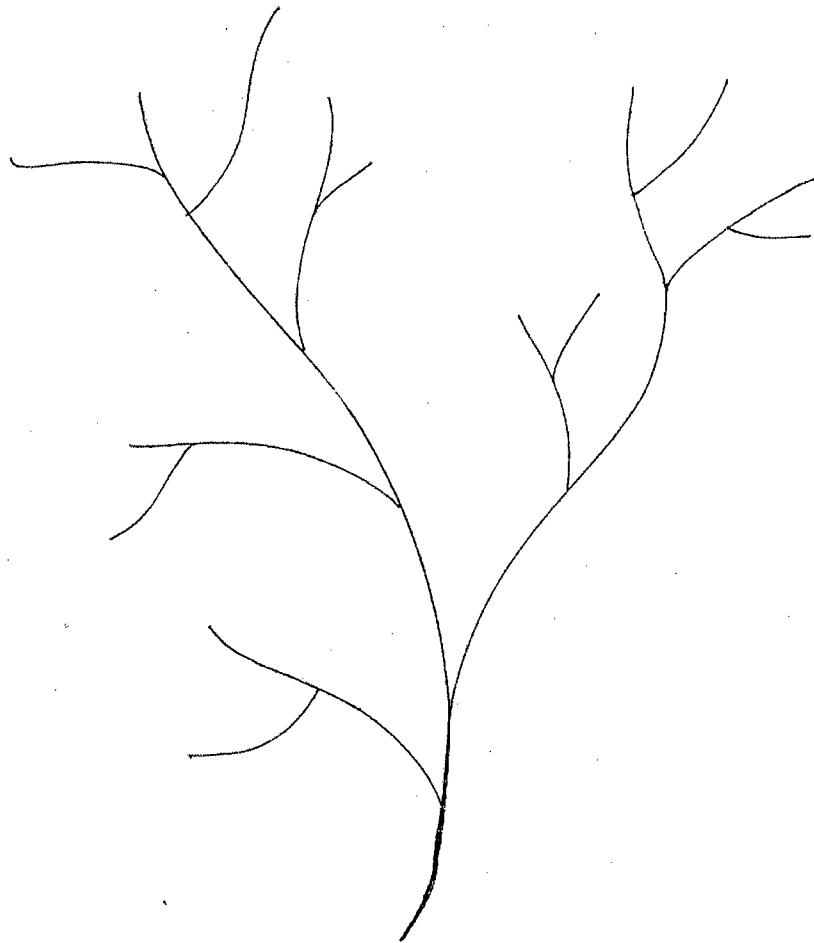## SECTION – A

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

1. (a) Describe the operation procedure of a Hoffman's kiln including the functions of different chambers and doors with neat sketch.   **(15)**

    (b) Differentiate between: **(4×4=16)**
    - (i)   Hydraulic lime and Artificial hydraulic lime
    - (ii) First class bats and Second class bats
    - (iii) Caustic lime and Slaked lime
    - (iv) Ordinary bricks and Machine made bricks

    (b) Write a short note on efflorescence.   **(4)**

2. (a) Define FRP. Write down the factors that affect the strength properties of FRP. Briefly describe the use of FRP as a retrofitting material.   **(1+3+5=9)**

    (b) Qualitatively draw the gradation curve of a sample of sand having: **(3×2=6)**
    - (i) Zero fineness modulus
    - (ii) Fineness modulus = 6

    Also comment on the type of the gradation curve.

    (c) The sieve analysis data of three types of aggregate is given below: **(13+3+3+2=20)**

Sieve No	% passing		
	Agg-1	Agg-2	Agg-3
2"	100	100	100
1 ½"	100	100	95
1"	100	100	51
¾"	100	100	25
½"	100	99	8
3/8"	100	89	2
NO.4	99	24	0
NO.8	85	3	-
NO.16	65	0	-
NO.30	38	-	-
NO.50	15	-	-
NO.100	4	-	-
NO.200	1	-	-
% in Total Mixture	45%	25%	30%

CE 291
Contd... Q. No. 2(c)

The aggregates mixed together to get a combined mixture of desired grading. Draw the gradation curve of the combined mixture and calculate:

    (i)   Fineness modulus and

    (ii) Uniformity coefficient

Also comment on the type of the gradation curve obtained by blending.

3.   (a) What is vulcanization? Write down the purposes of vulcanization. Briefly describe the purposes of different constituents of paint. **(2+2+5=9)**

    (b) Differentiate between: **(4×4=16)**

        (i)   Oil paint and Water paint

        (ii) Knotting and Stopping

        (iii) Thermo setting plastic and Thermo plastic

        (iv) Soft rubber and Hard rubber

    (c) Write down the requirements for commercial glass. Also mention the uses of the following special types of glass: **(2+8=10)**

        (i)   Plate glass

        (ii) Fluted glass

        (iii) Foam glass

        (iv) Wired glass

4.   (a) What is ferrocement? Write down the applications of ferrocement as a construction material. **(2+3=5)**

    (b) Make a comparison between cast iron, wrought iron and hard iron in terms of carbon content, elasticity, ductility and melting point. **(12+8=20)**

Write down the effect of the following impurities:

        (i)   Silicon and sulfur in iron

        (ii) Lime and alkalis in earth brick

    (c) Write short notes on: **(5×2=10)**

        (i)   Synthetic rubber

        (ii) Acoustical plaster.

CE 291

SECTION – B

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

Assume reasonable values for missing data, if any

5. (a) Differentiate between: (4×5=20)

      (i)   cement and lime

      (ii) the characteristics of elastic strain and plastic strain in materials

      (iii) functions of C_4AF and C_2S in cement

      (iv) function of alumina and silica as cement constituents

(b) The following masses are used to produce a batch of concrete. What is the mixing water content and water-cementitious material ratio for the following 1 m^3 batch of concrete? (10)

Material	Batch Mass (kg)
Cement	267
Fly Ash	89
Wet sand (absorption 1%, total moisture content 6.1%)	943
Wet gravel (absorption 0.7%, total moisture content 1.3%)	1092
Water (added through batching system)	146

(c) Briefly describe the phenomena of 'bulking of sand'. (5)

6. (a) Compute the mix proportions (SSD basis, lb/yd^3) for the concrete. What are the mix proportions for the trial batch after moisture adjustment?

Given:

Job Specification	
Type of Construction	RC Column
Exposure	Severe
Maximum size of aggregate	1.5 inch
Slump	3-4 inch
Specified 280-day compressive strength	4200 psi

Characteristics of the materials selected	Cement	Sand	Gravel
Bulk specific gravity	3.03	2.5	2.8
Bulk Density (lb/ft^3)	195	160	165
Dry-rodded unit weight (lb/ft^3)	-	-	100
FM	-	2.7	-
Moisture Deviation from SSD condition (%)	-	+2.4	+0.45

Design the mix as per ACI method using the above information and the data given in Annexure 1 to 3.

(b) Briefly describe various types of mortar. (10)

(c) What are the factors to be considered when determining the workability of concrete mixtures? (5)

CE 291

Contd... Q. No. 3

7. (a) Write short notes on: (4×5=20)

    (i) The characteristics of viscous strain in a material

    (ii) False setting of cement paste

    (iii) Desirable properties of sand

    (iv) Various tests for mortar

(b) For the loading history shown below, draw the likely strain response of (i) elasto-plastic and (ii) elasto-visco-plastic material. Assume equal time intervals, i.e.,
$\Delta t = t_1 - t_0 = t_2 - t_1 = t_3 - t_2$. (10)

Fig: Loading-unloading sequence
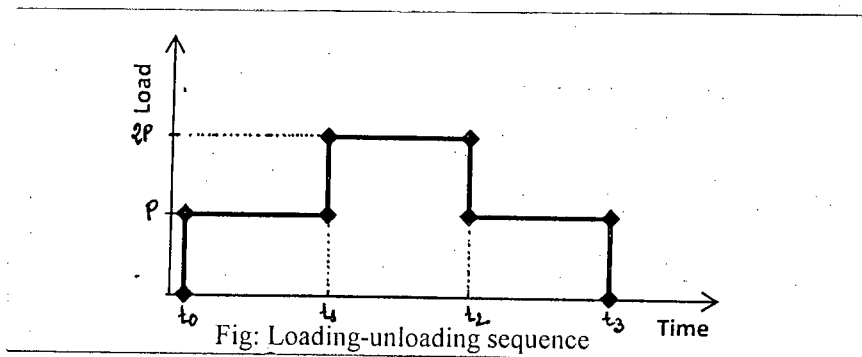
(c) Briefly state the stages of cement manufacturing process. (5)

8. (a) Differentiate between: (5×4=20)

    (i) Heartwood and sapwood

    (ii) Dry rot and wet rot

    (iii) Natural seasoning and water seasoning

    (iv) Wood and timber

    (v) Exogenous and endogenous trees

(b) Briefly describe five types of artificial wood. (10)

(c) Neatly sketch and label different parts of a timber section. (5)

ANNEXURE 1

TABLE 9-2 Approximate Mixing Water and Air Content Requirements for Different Slumps and Nominal Maximum Sizes of Aggregates

Slump, in.	Water, lb/yd³ of concrete for indicated nominal maximum sizes of aggregate							
	⅜ in.	½ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	6 in.
Non-air-entrained concrete								
1 to 3	350	335	315	300	275	260	220	190
3 to 4	385	365	340	325	300	285	245	210
6 to 7	410	385	360	340	315	300	270	—
More than 7	—	—	—	—	—	—	—	—
Approximate amount of entrapped air in non-air-entrained concrete, percent	3	2.5	2	1.5	1	0.5	0.3	0.2
Air-entrained concrete								
1 to 2	305	295	280	270	250	240	205	180
3 to 4	340	325	305	295	275	265	225	200
6 to 7	365	345	325	310	290	280	260	—
More than 7	—	—	—	—	—	—	—	—
Recommended averages total air content, percent for level of exposure								
Mild exposure	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
Moderate exposure	6.0	5.5	5.0	4.5	4.5	4.0	3.5	3.0
Severe exposure	7.5	7.0	6.0	6.0	5.5	5.0	4.5	4.0

The quantities of mixing water given for air-entrained concretes are based on typical total air content requirements as shown for "moderate exposure" in the table above.

The slump values for concrete containing aggregates larger than 1½ in. are based on the slump tests made after removal of particles larger than 1½ in. by wet-screening.

For concrete containing large aggregates that will be wet-screened over the 1½ in. sieve prior to testing for air content, the percentage of air expected in the 1½ in. minus material should be as tabulated in the column. However, initial proportioning calculations should include the air content as a percent of the whole.

When using large aggregate in low cement factor concrete, air entrainment need not be detrimental to strength. In most cases mixing water requirement is reduced sufficiently to improve the water-cement ratio and to thus compensate for the strength-reducing effect of air-entrained concrete. Generally, therefore, for these large nominal maximum sizes of aggregate, air contents recommended for extreme exposure should be considered even though there may be little or no exposure to moisture and freezing.

ANNEXURE 2

TABLE 9-3 Relationships between Water-Cement Ratio and Compressive Strength of Concrete

Compressive strength at 28 days (psi)*	Water-cement ratio, by weight	
	Non-air-entrained concrete	Air-entrained concrete
6000	0.41	—
5000	0.48	0.40
4000	0.57	0.48
3000	0.68	0.59
2000	0.82	0.74

*Values are estimated average strengths for concrete containing not more than percentage of air shown in Table 9-2. For a constant water-cement ratio, the strength of concrete is reduced as the air content is increased. Strength is based on 6 by 12 in. cylinders moist-cured 28 days at 73.4 ± 3°F (23 ± 1.7°C) in accordance with Sec. 9(b) of ASTM C31, for *Making and Curing Concrete Compression and Flexure Test Specimens in the Field.*
SOURCE: Reproduced with permission form the American Concrete Institute.

TABLE 9-4 Recommendations for Normal Weight Concrete Subject to Sulfate Attack

Exposure	Water soluble sulfate* (SO_4) in soil, percent	Sulfate* (SO_4) in water, ppm	Cement	Water-cement ratio, maximum[†]
Mild	0.00–0.10	0–150	—	—
Moderate[†]	0.10–0.20	150–1500	Type II IP (MS),IP (MS)[‡]	0.50
Severe	0.20–2.00	1500–10,000	Type V[§]	0.45
Very severe	Over 2.00	Over 10,000	Type V + pozzol and or slag[¶]	0.45

*Sulfate expressed as SO_4 is related to sulfate expressed as SO_3 as in reports of chemical analysis of cement as $SO_3 \times 1.2 = SO_4$.
[†]When chlorides or other depassivating agents are present in addition to sulfate, a lower water-cement ratio may be necessary to reduce corrosion potential of embedded items. Refer to Chap. 5.
[‡]Or a blend of Type I cement and a ground granulated blast furnace slag or a pozzolan that has been determined by tests to give equivalent sulfate resistance.
[§]Or a blend of Type II cement and ground granulated blast furnace slag or a pozzolan that has been determined by tests to give equivalent sulfate resistance.
[¶]Use a pozzolan or slag that has been determined by tests to improve sulfate resistance when used in concrete containing Type V cement.
SOURCE: ACI Committee 201, Guide to Durable Concrete, *ACI Mat. J.*, Vol. 88, No. 5, p. 553, 1991.

TABLE 9-5 Volume of Coarse Aggregate Per Unit of Volume of Concrete

Maximum size of aggregate (in.)	Volume of dry-rodded coarse aggregate* per unit volume of concrete for different fineness moduli of sand			
	2.40	2.60	2.80	3.00
$^3/_8$	0.50	0.48	0.46	0.44
$^1/_2$	0.59	0.57	0.55	0.53
$^3/_4$	0.66	0.64	0.62	0.60
1	0.71	0.69	0.67	0.65
$1^1/_2$	0.75	0.73	0.71	0.69
2	0.78	0.76	0.74	0.72
3	0.82	0.80	0.78	0.76
6	0.87	0.85	0.83	0.81

*Volumes are based on aggregates in dry-rodded condition as described in ASTM C29, *Unit Weight of Aggregate*. These volumes are selected from empirical relationships to produce concrete with a degree of workability suitable for usual reinforced construction. For less workable concrete such as required for concrete pavement construction they may be increased about 10 percent. For more workable concrete, such as may sometimes be required when placement is to be by pumping, they may be reduced up to 10 percent.

SOURCE: Reproduced with permission from the American Concrete Institute

TABLE 9-6 First Estimate of Weight of Fresh Concrete

Maximum size of aggregate (in.)	First estimate concrete weight* (lb/yd^3)	
	Non-air-entrained concrete	Air-entrained concrete
$^3/_8$	3840	3690
$^1/_2$	3890	3760
$^3/_4$	3960	3840
1	4010	3900
$1^1/_2$	4070	3960
2	4120	4000
3	4160	4040
6	4230	4120

*Values calculated for concrete of medium richness (550 lb of cement per cubic yard) and medium slump with aggregate specific gravity of 2.7. Water requirements based on values for 3 to 4 in. of slump in Table 9-2. If desired, the estimated weight may be refined as follows when necessary information is available: for each 10-lb difference in mixing water from the Table 9-2 values for 3 to 4 in. of slump, correct the weight per cubic yard 15 lb in the opposite direction; for each 100-lb difference in cement content from 550 lb, correct the weight per cubic yard 15 lb in the same direction; for each 0.1 by which aggregate specific gravity deviates from 2.7, correct the concrete weight 100 lb in the same direction.

SOURCE: Reproduced with permission form the American Concrete Institute.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1   B. Sc. Engineering Examinations 2014-2015

Sub : **HUM 313** (Principles of Accounting)

Full Marks: 140   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. (a) Define the following cost terms with example: differential cost, opportunity cost and sunk cost. **(6)**

(b) Write down the classification of manufacturing cost with example. **(4)**

(c) The following costs and inventory data are taken from the accounting records of Grand steel company for the year ended on **December 31st, 2014-** **(13⅓)**

Cost Data	Amount (Tk.)
Cost incurred:	
Direct labor cost	70,000
Purchase of raw material	118,500
Indirect labor	30,000
Maintenance, factory	6,000
Advertising expense	90,000
Insurance, factory	800
Sales commission	35,000
Administrative manager's salary	55,000
Supervisor's salary	12,000
Rent, factory	30,000
Rent, office	25,000
Rent for showroom	13,000
Utilities (70% factory, 30% office)	15,000
Supplies (60% factory, 40% office)	3,000
Power and electricity, factory	2,500
Fuel for factory equipment	700
Depreciation, factory equipment	30,000
Legal fees	15,000
Sales	8000,00

HUM 313

Contd... Q. No. 1(c)

Inventories	January 1, 2014 (Tk.)	December 31, 2014 (Tk.)
Raw materials	7,000	15,000
Work in process	10,000	5,000
Finished goods	20,000	35,000

Required:

    (i)   Prepare a cost of goods sold statement in a good form.   **(13⅓)**

2.   (a) In all respects, Company A and Company B are identical except that Company A's costs are mostly variable, whereas Company B's costs are mostly fixed. When sales increase, which company will tend to realize the greatest increases in profits? Explain.   **(3⅓)**

(b) Quality Products manufactures plastic football. The **selling price** is Tk. 37.50 per unit and **variable cost** is Tk. 22.50 per unit. Over the past company **sold 40,000 units** of football, with the following results: **(20)**

Sales	Tk. 1,500,000
Less: variable expenses	Tk. 900,000
Contribution margin	Tk. 600,000
Less: fixed expenses	Tk. 480,000
Net operating income	Tk. 120,000

Required:

    (i)   Compute CM ratio and break even points in units and in amounts. Also compute degree of operating leverage of sales.

    (ii)   The company estimates that, in the next year variable cost will increase by Tk. 3 per football. The selling price will remain constant at Tk. 37.50 per football. What will be the new CM ratio and the new break even points in units and amounts?

    (iii) Refer to the data (ii) above if the expected change in variable costs take place how many footballs will have to be sold to earn the same net operating income (Tk. 120,000) as last year?

    (iv) Refer to the original data, assume that if variable cost will decrease by 40% but fixed cost will increase by 90%. What would be the new CM ratio and break even Points in units and amounts?

    (v)   Refer to the (iv) above, assume that in next year company will sell 50,000 units of football. Compute- contribution margin format income statement and margin of safety in units.

HUM 313

3. (a) "Aqua guard Company" manufactures and sells single product. You have been given the following information- **(18⅓)**

Particulars	Amount (Tk.)
Variable cost per unit:	
Direct materials	18
Direct labor	7
Variable manufacturing overhead	2
Variable selling and administrative expenses	5
Fixed cost per year:	
Fixed manufacturing overhead	160,000
Fixed selling and administrative expenses	110,000

During the year, the company produced 20,000 units and sold Tk. 16,000 units. The selling price of per unit is Tk. 50.

Required:

(i) Calculate the product cost per unit under absorption costing system and variable costing system.

(ii) Prepare income statement under absorption costing system and variable costing system.

(iii) Reconcile the amount of profits under two costing systems.

(b) Explain how fixed manufacturing overhead costs are shifted from one period to another under absorption costing system? **(5)**

4. (a) There are several methods for segregation of mixed cost. According to you which method you think is the best? Why? **(4)**

(b) What are the purposes of cost allocation? **(4)**

(c) "Singer Company" provides management consulting services to government and corporate clients. It has two supports departments- Finance (FIN) and Information technology (IT)- and two operating departments- Government Consulting (GOVT) and Corporate Consulting (CORP). For the year 2014, the following information were available. **(15⅓)**

Budgeted overhead before allocation	Support Dept.		Operating Dept.		Total 284,000
	FIN	IT	GOVT	CORP	
	60,000	24,000	80,000	120,000	
Support work by FIN	–	25%	40%	35%	100%
Support work by IT	10%	–	30%	60%	100%

Required:

Allocate two supports departmental cost to the two operating departments by using–

(i) Direct method.

(ii) Step-down method.

(iii) Reciprocal method.

HUM 313

SECTION – B

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

5. (a) What is Revenue Recognition Principle? Explain with examples. **(4)**

    (b) Are the following events recorded in the accounting records? Explain your answer. **(4)**

    (i)   Purchase furniture on account.

    (ii) Hired an employee but no advance in paid.

    (iii) Withdraw money for personal use by the owner.

    (iv) CEO (Chief Executive Officer) of the company dies.

    (c) Thompson Kerry's transaction related to his grocery shop are as follows: **(10+5⅓)**

    • Invested Tk. 10000 cash to the business.

    • Sell goods in cash Tk. 20000.

    • Paid shop rent Tk. 4000.

    • Paid employee salary Tk. 2000.

    • Purchase furniture on account Tk. 10000.

    (i) Prepare a tabular analysis for the transactions.

    (ii) From the table prepare the Income Statement of the month June 30, 2014.

6. (a) What are the limitations of trial Balance? **(5)**

    (b) Stephen Ken's transaction for the month August 31, 2015 are presented below: **(14+4⅓)**

    • Invested Tk. 25000 cash.

    • Purchase supplies on account of Tk. 2500.

    • Paid office rent Tk. 10000.

    • Service provided to customer and billed Tk. 5000.

    • Purchase office equipment on account Tk. 10000.

    • Withdraw cash Tk. 1000 from the business.

    • Get cash from dues on service provided.

    (i) Record Journal entries in appropriate format.

    (ii) Prepare Cash ledger and Accounts Payable ledger.

HUM 313

7. (a) Describe the terms 'Asset' and 'Liability' with criteria and examples.　　**(7)**

(b) Followings are the balance figures from the ladger of Zan company. Prepare appropriate trial balance from the accounts.　　**(10⅓)**

Cash Tk. 8700; Accounts Receivable Tk. 11500; supplies Tk. 650; Prepaid Insurance Tk. 1200; Equipment Tk. 18000; Accumulated Depreciation Equipment Tk. 700; Notes payable Tk. 10000; Accounts payable Tk. 2500; Salaries payable Tk. 725; Interest payable Tk. 100; Unearned Rent Revenue Tk. 1050; Owner's Capital Tk. 22000; Owner's drawings Tk. 1600; Service Revenue Tk. 17100; Rent Revenue Tk. 2260; Salaries Expense Tk. 8725; Rent Expense ti. 2900; Depreciation Expense Tk. 700; Supplies Expense Tk. 850; Utilities Expense Tk. 1510; Interest expense Tk. 100.

(c) Prepare adjusting journal entries for the transactions below:　　**(6)**

   (i) Travel expenses accrued Tk. 2000.

   (ii) Tk. 1000 of unearned revenue is earned.

   (iii) Prepaid Insurance expires Tk. 500 per month.

8. The adjusted trial balance of Frinzi Company is presented below:　　**(23⅓)**

Frinzi Company
Trial Balance
December 31, 2014

	Debit (Tk.)	Credit (Tk.)
Cash	5400	
Accounts Receivable	2400	
Supplies	2800	
Prepaid insurance	1300	
Equipment	60000	
Notes payable		40000
Accounts payable		2400
Owners, Capital		30000
Owner's Drawings	1000	
Service Revenue		4900
Salary expense	3200	
Utility expense	800	
Advertising expense	400	
Total=	77300	77300

Required:

   (i) Prepare a non-classified Income Statement and Owner's Equity Statement.

   (ii) Prepare a classified Balance Sheet assuming 20000 of the notes payable is long-term.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1   B. Sc. Engineering Examinations 2014-2015

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

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. (a) Find the differential equation of all circles having their centres on the line y = x.   **(11)**

   (b) Solve: $\left(y^3 - 4xy^2 - 2x^3\right)dx + x^2(2y + x)dy = 0$.   **(12)**

   (c) Test the exactness of the following differential equation and hence solve it: **(12)**

   $$\left(3 + y + 2y^2 \sin^2 x\right)dx + \left(x + 2xy - y\sin 2x\right)dy = 0$$

2. (a) The radius of the moon is roughly 1080 miles. The acceleration of gravity at the surface of the moon is about 0.165 g, where g is the acceleration of gravity at the surface of the earth. Determine the velocity of escape for the moon.   **(11)**

   (b) Find an integrating factor of the following equation and hence solve it: **(12)**

   $$\left(1 + \cos x\right)\frac{dy}{dx} = \sin x\left(\sin x + \sin x \cos x - y\right).$$

   (c) Solve the Bernoulli's equation: **(12)**

   $$6y^2 dx - x\left(2x^3 + y\right)dy = 0$$

3. (a) Solve: $4y^2 p^2 + 2(3x+1)xyp + 3x^3 = 0$, where $p = \dfrac{dy}{dx}$.   **(10)**

   (b) Solve: $\left(D^4 + 18D^2 + 81\right)y = \sin(3x+2)$.   **(13)**

   (c) Solve the Cauchy - Euler equation: **(12)**

   $$x^3 \frac{d^3 y}{dx^3} + 6x^2 \frac{d^2 y}{dx^2} + 8x\frac{dy}{dx} + 2y = x^2 + 3x - 4.$$

4. Solve the following differential equation by the method of Fröbenius: **(35)**

   $$9x\left(1 - x\right)\frac{d^2 y}{dx^2} - 12\frac{dy}{dx} + 4y = 0.$$

MATH 231

SECTION – B

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

Symbols used have their usual meaning.

5. (a) Form a PDE by eliminating the arbitrary function f from the equation

$$x + y + z = f\left(x^2 + y^2 + z^2\right).$$

(12)

    (b) Solve: (i) $\left(\dfrac{b-c}{a}\right)yzp + \left(\dfrac{c-a}{b}\right)zxq = \left(\dfrac{a-b}{c}\right)xy.$

(11)

                 (ii) $yz^2 p^2 + 6xyzp + 2x^2 zq + 4x^2 y = 0$

(12)

6. (a) Find the complete and singular integrals of

$$z^2\left(p^2 z^2 + q^2\right) = 1.$$

(12)

    (b) Solve: (i) $\dfrac{\partial^3 z}{\partial x^3} - 4\dfrac{\partial^3 z}{\partial x^2 \partial y} + 4\dfrac{\partial^3 z}{\partial x \partial y^2} = 2\sin(3x + 2y).$

(13)

                 (ii) $x^2 \dfrac{\partial^2 z}{\partial x^2} - y^2 \dfrac{\partial^2 z}{\partial y^2} = x^2 y$

(10)

7. (a) Show that   (i) $\dfrac{d}{dx}\left[J_n^2(x) + J_{n+1}^2(x)\right] = 2\left(\dfrac{n}{x}J_n^2(x) - \dfrac{n+1}{x}J_{n+1}^2(x)\right)$

(10)

                 (ii) $\displaystyle\int_0^x x^2 J_0(x) J_1(x)\,dx = \dfrac{x^2}{2}J_1^2(x).$

(10)

    (b) Prove that $x^2 J_n''(x) = \left(n^2 - n - x^2\right)J_n(x) + xJ_{n+1}(x)$

(15)

8. (a) Express $x^4 + 2x^3 + 2x^2 - x - 3$ in terms of Legendre polynomials.

(10)

    (b) Show that $\displaystyle\int_{-1}^{1}\left[P_n(x)\right]^2 dx = \dfrac{2}{2n+1}.$

(15)

    (c) Show that $P_n(-x) = (-1)^n P_n(x)$ and hence deduce that $P_n(-1) = (-1)^n.$

(10)