

L-2/T-1/CE

Date : 07/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **HUM 353** (Accounting)

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) Discuss the concepts – costs, expenses, losses and assets. Give one example illustrating the relationship between them. (4)

- (b) The data below have been taken from the cost records of Beverly Hospital. A careful study by the company's cost analyst has determined that if the number of x-rays taken is 7000, the average operating cost is Tk. 4.14 per x-ray. If the number of x-rays taken is 3000, the average operating cost is Tk. 5.65 per x-ray. (12)

**Required:**

- (i) Using the high-low point method, determine the variable cost per x-ray taken and the fixed cost in total.  
(ii) Express the variable cost and fixed cost in the cost formula.  
(iii) If the number of x-rays taken in a month is 4600, what total operating x-rays costs would you expect?  
(iv) What is the major disadvantage of high-low point method?

- (c) Various costs associated with manufacturing operations are given below: (7 1/3)

- (i) Plastic washers used in auto production;  
(ii) Clay used in brick production;  
(iii) Boxes used for packing detergent;  
(iv) Cost of x-ray film at Matro Clinic Radiology Lab;  
(v) Wages of workers assembling computers;  
(vi) Shipping cost of merchandise sold;  
(vii) Executive life insurance;  
(viii) Thread in a garment factory;  
(ix) Depreciation of cafeteria equipment;  
(x) Glue used in suit production;  
(xi) Screws used in ski production.

Classify each cost as either variable or fixed with respect to volume or level of activity. Also indicate whether each cost would typically be treated as a direct or an indirect cost with respect to units of product.

Contd ..... P/2

**HUM 353**

2. (a) What do you understand by cost structure?

(5)

(b) Bogside Farm and Sterling Farm are two blueberry farms. Bogside Farm has higher variable cost as it depends on migrant workers to pick its berries by hand, where as Sterling Farm has higher fixed cost as a result of its investment in expensive machine to pick its berries. Following are the income statements of these two blueberry farms:

(18 1/3)

	<u>Bogside Farm</u>	<u>Sterling Farm</u>
Sales	Tk. 100,000	Tk. 100,000
Less: Variable costs	<u>60,000</u>	<u>30,000</u>
Contribution	40,000	70,000
Less: Fixed costs	<u>30,000</u>	<u>60,000</u>
Net profit	<u>10,000</u>	<u>10,000</u>

**Required:**

(i) Considering CM ratio, break-even point and margin of safety expression which farm has the better cost structure.

(ii) Explain which farm will earn greater profit under the conditions of 10% increase in sales and 10% decrease in sales (show the calculations).

3. (a) What is the basic difference between absorption costing and variable costing?

(5)

(b) Chuck Wagon Grills manufacturing company makes a single product – a handmade specially barbecue grill that it sells for Tk. 210. Data for last year's operations are as follows:

(18 1/3)

Units in beginning inventory	0
Units produced	20,000
Units sold	19,000
Units in ending inventory	1000
Variable costs per unit:	
Direct Materials	Tk. 50
Direct Labour	80
Variable manufacturing overhead	20
Variable selling and administrative overhead	10
Total variable cost per unit	<u>Tk. 160</u>
Fixed costs (Total):	
Fixed manufacturing overhead	Tk. 700,000
Fixed selling and administrative overhead	285,000
Total fixed cost	<u>Tk. 985,000</u>

Contd ..... P/3

## HUM 353

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

### **Required:**

- (i) Compute unit production cost under both absorption costing and variable costing methods;
- (ii) Prepare income statements under both of the methods;
- (iii) Reconcile the amount of net income under two methods.

4. (a) What is contribution margin? How does it help in managerial decision making process? (4)
- (b) What is degree of operating leverage? The degree of operating leverage for X company is 5 times where as it is 7 times for Z company. What does it imply? (4)
- (c) The following costs and inventory data are taken from the accounting records of Meriwell company for the year ended on December 31st, 2010. (15 1/3)

### **Cost Incurred:**

Direct labour cost	Tk. 70,000
Purchase of raw materials	118,500
Indirect labour	30,000
Maintenance, factory equipment	6,000
Advertising expenses	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% for factory, 30% for office)	15,000
Supplies (60% for factory, 40% for office)	3,000
Power and electricity	2,500
Fuel for factory equipment	700
Depreciation, factory equipment	30,000
Legal fees	15,000

<u>Inventories</u>	<u>January 01, 2010</u>	<u>December 31, 2010</u>
Raw materials	Tk. 7,000	Tk. 15,000
Work in process	10,000	5,000
Finished goods	20,000	35,000

**Required:** Prepare a statement of Cost of Goods Sold in good form.

Contd ..... P/4

## **HUM 353**

### **SECTION - B**

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

5. (a) What is materiality assumption? Explain with example. (3 1/3)
- (b) Explain the statement, "Every transaction is an event, but every event is not a transaction". (2)
- (c) State what is the effect of revenue and expense on the owner's equity in accounting equation. (2)
- (d) Mr. Kabir started his own business "Kabir Enterprise" on June 1, 2010. The following transactions occurred during the month of June: (16)
- June 1 : Kabir invested Tk. 70,000 cash in the business.
  - June 2 : Placed an order for purchasing goods for Tk. 5,000 from an outside supplier.
  - June 5 : Purchased a delivery van for Tk. 10,000 paid Tk. 2,000 cash and signed a note payable for the remaining balance.
  - June 9 : Performed Tk. 2,400 of service on account.
  - June 12 : Made a cash payment of Tk. 500 on the note payable.
  - June 17 : Purchased supplies for Tk. 500 on account.
  - June 20 : Received a cash payment of Tk. 1,000 for service provided on June 9.
  - June 26 : Paid Tk. 1,000 for a employee salary.

**Required:** Show the effects of transaction on the accounting equation.

6. (a) "Journalizing records data chronologically" – discuss. (2)
- (b) Explain why a trial balance is required? (3 1/3)
- (c) Listed below are the transactions of Mr. Sumon for the month of May 2012: (18)
- May 1 : Invested Tk. 30,000 cash in the business.
  - May 5 : Paid rent for the next month Tk. 2,000.
  - May 8 : Paid salary expense Tk. 3,000 cash.
  - May 10 : Withdraw cash Tk. 1,500 from the business.
  - May 11 : Received Tk. 3,500 advance from a customer.
  - May 12 : Purchased supplies for Tk. 1,500 on account from Read Supply Company.
  - May 15 : Received cash Tk. 8,900 against service performed.
  - May 16 : Paid 40% of balances of Read Supply.
  - May 22 : Paid advertising expense Tk. 800.

**Required:**

- (i) Journalize the transactions.
- (ii) Prepare the ledger of "Read Supply Account" and "Mr. Sumon Capital Account".

**HUM 353**

7. (a) "An adjusting entry may affect more than one balance sheet or income statement account". Do you agree? Why or why not?

(3 1/3)

(b) The trial balance of Alam Company for the month of January 31, 2012 before adjustment is given below:

(20)

Alam Company  
Trial Balance  
January 31, 2012

Account Title	Debit (Tk.)	Credit (Tk.)
Cash	12,000	---
Accounts Receivable	5,500	---
Machinery	5,000	---
Accounts Payable	---	3,500
Notes, Payable	---	4,500
Alams Capital	---	16,600
Store Furniture	6,000	---
Rent expense	2,400	---
Supplies	1,300	---
Service Revenue	---	2,600
Unearned Service Revenue	---	5,000
Total	32,200	32,200

Other information:

- Rent is accrued but not paid for month Tk. 600.
- Unused supplies on hand at January 31 is Tk. 200.
- The store equipment is being depreciated Tk. 200 per month.
- Service performed to a customer Tk. 1,100 but not collected during the month.
- Unearned Service Revenue has been earned during the period Tk. 3,000.

**Required:**

- (i) Prepare adjusting entries,
- (ii) Prepare an adjusted trial balance at January 31, 2012.

**HUM 353**

8. The trial Balance for Premium Bus Service at December 31, 2011 is given below –

Premium Bus Company

Trial Balance

December 31, 2011

Account Title	Debit (Tk.)	Credit (Tk.)
Cash	18,000	---
Accounts Payable	---	4,800
Accounts Receivable	5,700	---
Unearned Service Revenue	---	6,000
Service Revenue	---	24,000
Rent expense	7,000	---
Prepaid Insurance	4,000	---
Supplies	500	---
Machinery	20,000	---
Salary expense	4,600	---
Capital	---	25,000
Total	59,800	59,800

Adjustments:

Salaries accrued but not paid Tk. 1,400.

Insurance expired Tk. 3,000 during the capital period.

**Required:**

(a) Prepare –

(17 1/3)

(i) A single step income statement,

(ii) An owners equity statement, and

(iii) A Classified Balance Sheet at December 31, 2011.

(b) Compute –

(6)

(i) Quick or Acid Test Ratio,

(ii) Return on Asset (ROA) Ratio,

(iii) Return on Equity (ROE) Ratio.

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

1. (a) State function of lime in Bricks. When does its presence become harmful for Bricks? Briefly explain. (5)
- (b) Write short notes on FRP and CRP. (10)
- (c) State merits and demerits of continuous kiln in brick manufacturing process. Mention the disadvantages of intermittent kiln. (10)
- (d) What are the differences between plywood and fiberboard? (10)
2. (a) What is difference between wood and timber? (5)
- (b) Write down merits and demerits of timber as structural member. (10)
- (c) Write down the characteristics of good brick. (10)
- (d) Write down the precautions which are undertaken in using cement mortar. Write short notes on gauged mortar and stone screenings. (10)
3. (a) Design compressive strength of concrete structure is 4000 psi. The test results of concrete are as follows: (15)
 

day 1	:	(2600 psi, 4500 psi), (3000 psi), 4680 psi, (4200 psi, 4520 psi)
day 2	:	(3500 psi, 4000 psi), (3700 psi, 3900 psi)
day 3	:	(4100 psi, 4450 psi)
day 4	:	(4400 psi, 4250 psi)
- Are these test results satisfactory?
- (b) How can you measure workability of fresh concrete by slump test, show with neat sketches. What is the limitation of slump test? (10)
- (c) "Compressive strength, w/c ratio and workability of concrete are related." – Explain. (10)

**CE 201**

4. (a) Design compressive strength of concrete pile cap and pile is 3000 psi. Required slump value for pile cap concrete and pile concrete is 50 – 100 mm and 150 – 200 mm respectively. Estimate the cement required per m<sup>3</sup> of concrete for pile cap and pile. Assume reasonable values for missing data. Use attached tables. (20)
- (b) Why is bulk specific gravity greater than dry rodded bulk density in g/cm<sup>3</sup>? (5)
- (c) "Strength, durability and economy must be considered in concrete production" – Explain why? (10)

**SECTION – B**

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

5. (a) State merits and demerits of using blocks instead of bricks. (10)
- (b) Define hydraulic lime and mention its properties. Show by flow diagram, how can you obtain fat lime from its natural resources. (3+5+5)
- (c) State specialities of artificial cement over natural cement. Name three main ingredients of cement including average percentage in OPC. (6+3+3)
6. (a) Write down the specialities of the following modified cement over OPC in ingredients and usages: (8+8)
- Rapid hardening cement
  - Low heat cement
- (b) Describe what preventive measures can be adopted for protecting RC members and steel members from corrosion. Give neat sketches where applicable. (9 1/2 + 9 1/2)
7. (a) Draw a typical section of ferrocement. Mention the specifications of each of the component materials as per BNBC (1993). (15)
- (b) What is spalling of concrete? How does it occur? Provide neat sketches. (5)
- (c) Describe with neat sketches how ferrocement can be used in order to rapid spalling of a floor slab. Why should such repair work is likely to be an effective solution? (10+5)



**CE 201**

8. (a) Describe the following terms with neat sketches for mild steel:

(10)

(i) Proportionality limit

(ii) Yield point

(iii) Elastic limit

(iv) Modulus of Resilience

(v) Modulus of toughness

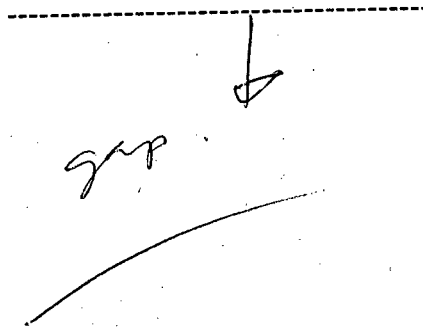
(b) Illustrate the characteristics of strain components of (i) an elastic material (ii) an elasto-plastic material and (iii) an elasto-visco-plastic material.

(2+4+4)

(c) For the loading history shown below, draw the possible strain response of (i) plastic material and (ii) an elasto-plastic material. Assume equal time intervals, i.e.

(7+8)

$$\Delta t = t_1 - t_0 = t_2 - t_1 = t_3 - t_2 \dots \dots \text{etc.}$$



L-2/T-1/CE

Date : 17/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **CE 201** (Engineering Materials)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable values for missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION – A**

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Briefly explain. (5)  
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Are these test results satisfactory?  
(b) How can you measure workability of fresh concrete by slump test, show with neat sketches. What is the limitation of slump test? (10)  
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Contd ..... P/2

**CE 201**

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- (b) Why is bulk specific gravity greater than dry rodded bulk density in g/cm<sup>3</sup>? (5)
- (c) "Strength, durability and economy must be considered in concrete production" – Explain why? (10)

**SECTION – B**

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- (c) State specialities of artificial cement over natural cement. Name three main ingredients of cement including average percentage in OPC. (6+3+3)
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**CE 201**

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(b) Illustrate the characteristics of <sup>strain</sup> components of (i) an elastic material (ii) an elasto-plastic material and (ii) an elasto-visco-plastic material.

(2+4+4)

(c) For the loading history shown below, draw the possible strain response of (i) a plastic material and (ii) an elasto-plastic material. Assume equal time intervals, i.e.

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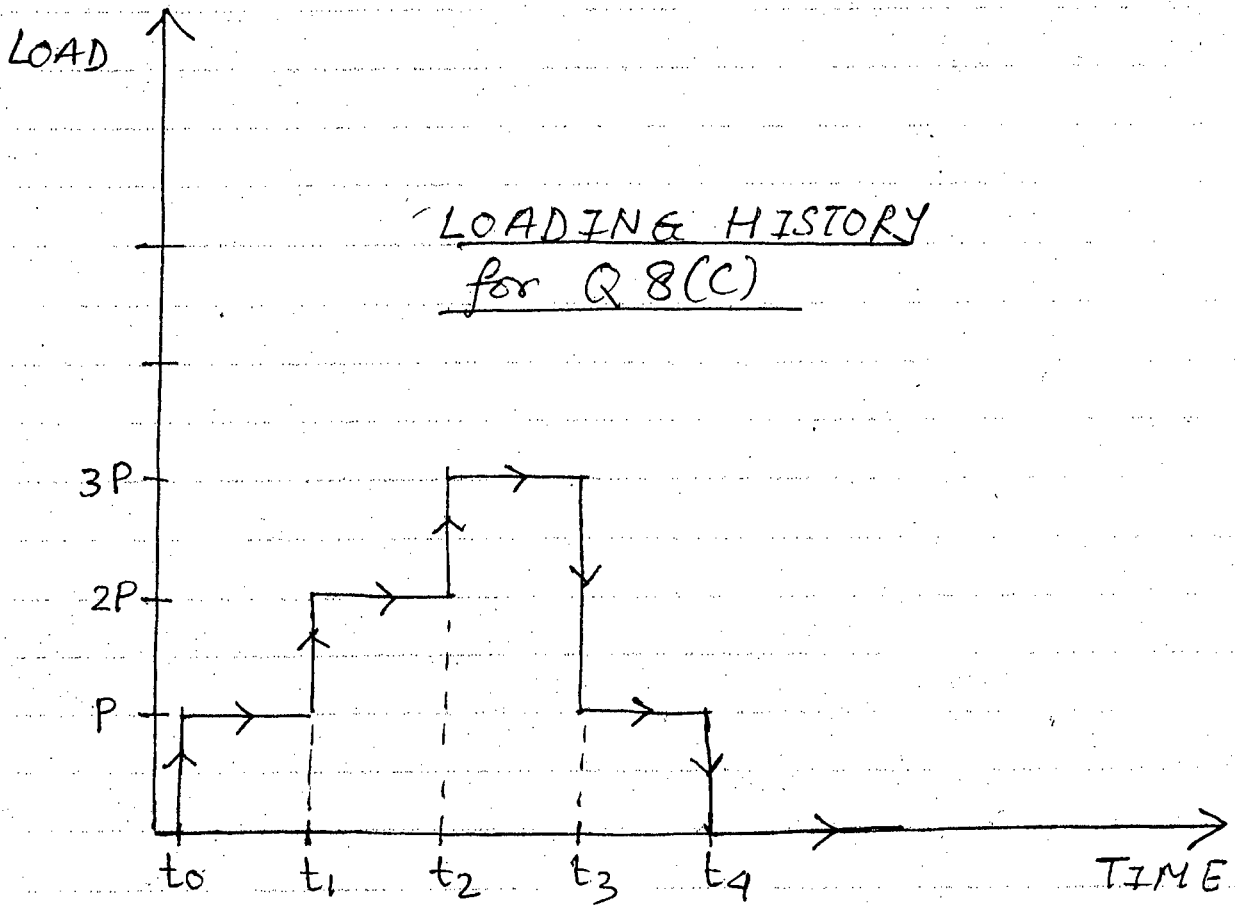


Table 1: ACI recommended w/c ratio for normal strength concrete

Mean target strength		w/c ratio
psi	MPa	
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 mm	FM of fine aggregate			
	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<sup>3</sup> 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 <sup>3</sup> 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	$1.10f'_c + 700$

Table 5: Quality control as per ACI

To ensure adequate concrete strength in spite of such scatter, the ACI code stipulates that concrete quality is satisfactory if (i) no individual strength test result (the average of a pair of cylinder tests) falls below the required  $f'_c$  by more than 500 psi when  $f'_c$  is 5000 psi or less or by more than  $0.10 f'_c$  when  $f'_c$  is more than 5000 psi, and (ii) every arithmetic average of any three (pair) consecutive strength tests equals or exceeds  $f'_c$ .

**SECTION – A**

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

Assume reasonable value for any missing data.

1. (a) A 80 mm square (alloy steel) bar, 1.5 metre long is subjected to an axial energy load of 128.50 kN-mm. What must be the proportional limit of the steel to safely resist the energy load with a factor of safety of 4.0? Given:  $E = 210,000 \text{ MPa}$ . (14)  
 (b) If the area of the above bar is reduced by 50% for half of its length (i.e. area reduced to  $3200 \text{ mm}^2$ ), compute the maximum stress in this bar for the same energy load input (128.50 kN-mm). Compare the change in maximum stress. (12 ¼)
2. A horizontal bar of negligible mass, hinged at A (Fig. 1) and assumed rigid, is supported by a bronze rod 2.0 m long and a steel rod 1.0 m long. Compute the stress in each rod. Given:  $A_{br} = 300 \text{ mm}^2$ ,  $A_{st} = 600 \text{ mm}^2$ ,  $E_{br} = 83 \text{ GPa}$ ,  $E_{st} = 200 \text{ GPa}$  and proportional limit of bronze and steel are 140 MPa and 240 MPa respectively. (26 ¼)
3. For the structure shown in Fig. 2, calculate the size of the single bolt and area of the bearing plates and blocks required. Ignore reduction of area due to threads in the bolt and self weight of beams. Allowable stresses are 155 MPa in tension and 5 MPa in bearing respectively. (26 ¼)
4. A solid shaft in a rolling mill transmits 20 kW at 2 hertz. Determine the diameter of the shaft if shearing stress is not to exceed 48 MPa and angle of twist is limited to  $5^\circ$  in a length of 3.0 metre. Use  $G = 83 \text{ GPa}$ . (26 ¼)
5. (a) A torque of 770 N-m is applied to the rectangular section shown in Fig. 3. Determine the wall thickness 't' so as not to exceed a shear stress of 80 MPa. Find the size of the square tubular section having identical tube thickness that can be used as a replacement for this rectangular section. (12)  
 (b) A steel rod with a cross-section area of  $160 \text{ mm}^2$  is stretched between two fixed points. The tensile load at  $20^\circ\text{C}$  is 4800 N. What will be the stress at  $0^\circ\text{C}$ ? At what temperature will the stress be zero? Assume  $\alpha = 11.7 \times 10^{-6} \text{ m/(m}^\circ\text{C)}$  and  $E = 200 \text{ GPa}$ . (14 ¼)

**CE 211**

**SECTION - B**

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

6. For the beam shown in Fig. 4.
  - (a) Draw the shear force and bending moment diagrams. Identify the maximum shear force and maximum moment in the diagrams. (8  $\frac{1}{4}$ )
  - (b) Determine the location of neutral axis and the moment of inertia of the cross-section. (6)
  - (c) Find the maximum shear stress. Draw the shear stress and shear flow diagram along the depth. (12)
  
7. (a) Determine the location of the shear center 'O' of a thin walled beam of uniform thickness (t) having the cross-section shown in Fig. 5. (13  $\frac{1}{4}$ )
  - (b) A timber beam AB as shown in Fig. 6 is to support the three concentrated loads shown. If the allowable bending stress is 1800 psi and allowable shear stress is 140 psi, determine the minimum required depth 'd' of the beam. (13)
  
8. A Cylindrical pressure vessel is fabricated from steel plating that has a thickness of 20 mm. The diameter of the pressure vessel is 450 mm and its length is 2.0 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa and the circumferential (Hoop) stress is limited to 60 MPa. (13  $\frac{1}{4}$ )
  - (b) For the planar structure shown in Fig. 7, find the reactions and determine the axial force P, the shear force V and the bending moment M caused by the applied loads at section a-a. (13)
  
9. (a) Draw shear force and bending moment diagrams for the beam shown in Fig. 8. (13  $\frac{1}{4}$ )
  - (b) A wooden box beam made up from 2 in thick boards, has the dimensions shown in Fig. 9. If the beam transmits a vertical shear of 800 lb, what should be the longitudinal spacing of the nails (i) for connecting board A with boards B and C, and (ii) for connecting board D with boards B and C? The shear capacity of each nail is 50 lb. (13)
  
10. Determine the reactions and draw axial force, shear force and bending moment diagrams for the beam shown in Fig. 10. Show the location and magnitude of maximum moment in the moment diagram. (26  $\frac{1}{4}$ )

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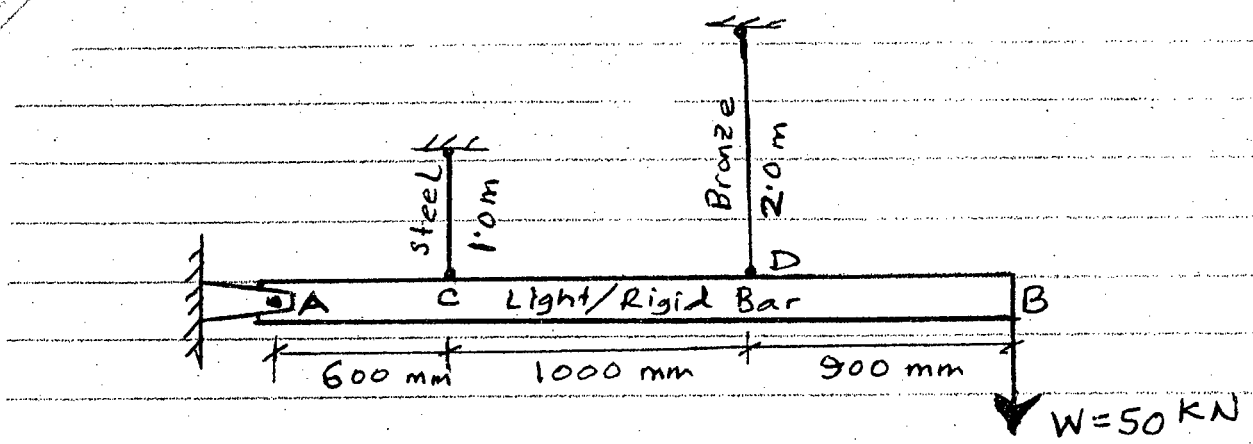


Fig. 1

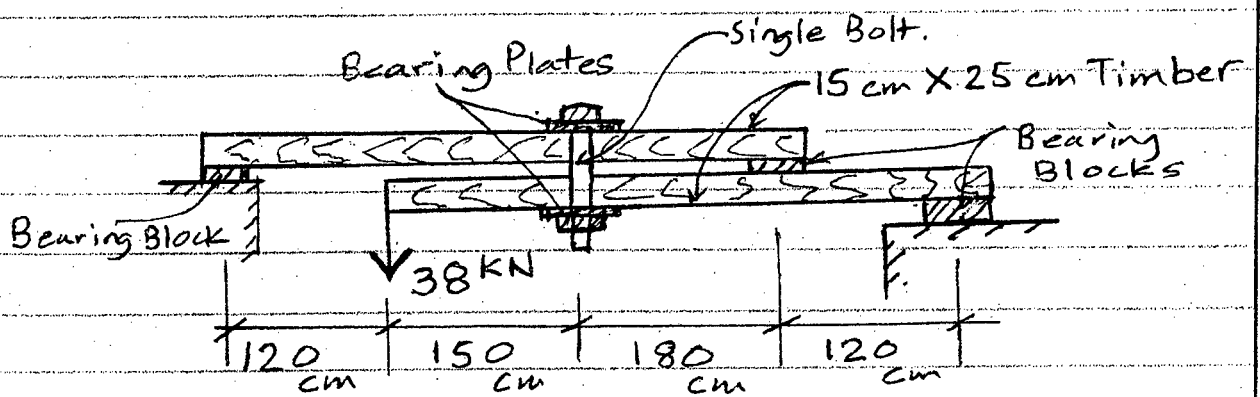


Fig. 2

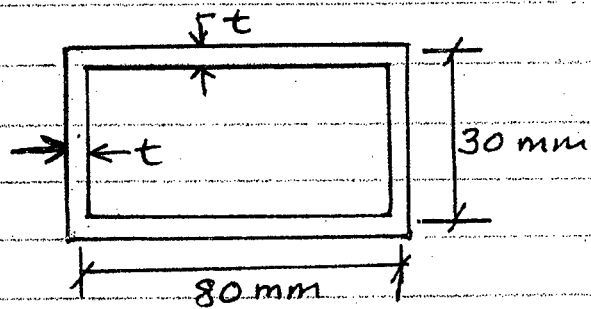


Fig. 3

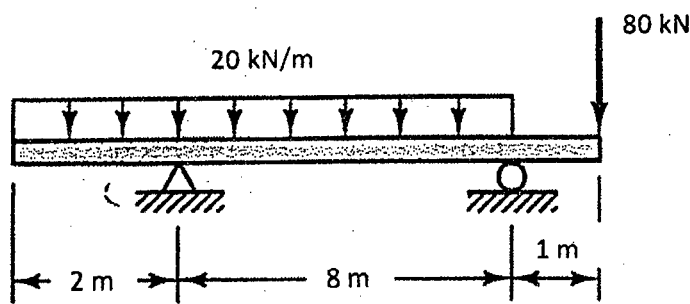
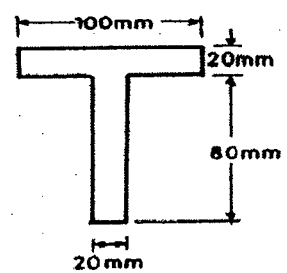


Fig. 4



X-section

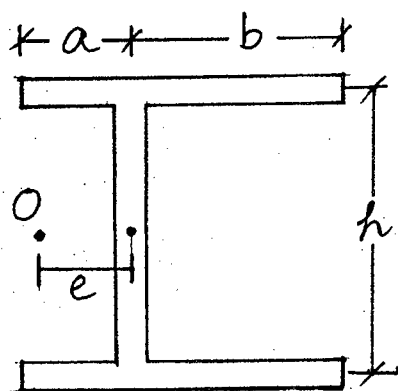


Fig. 5

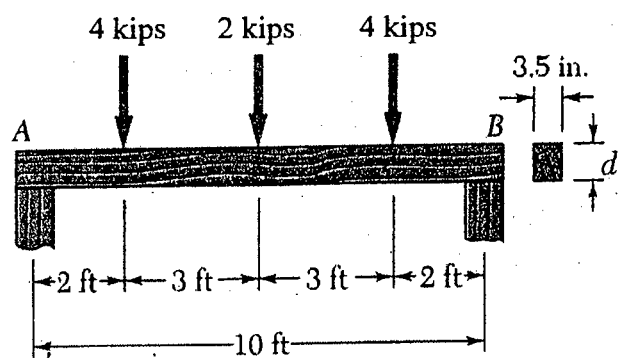


Fig. 6



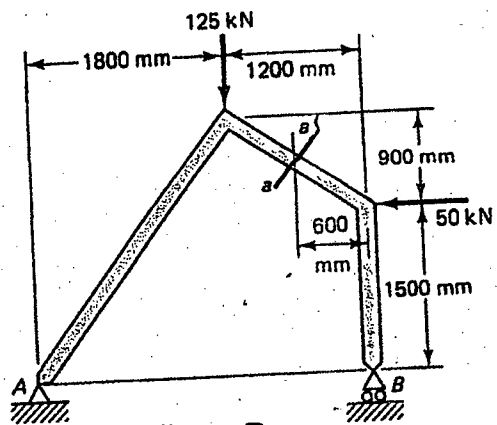


Fig. 7

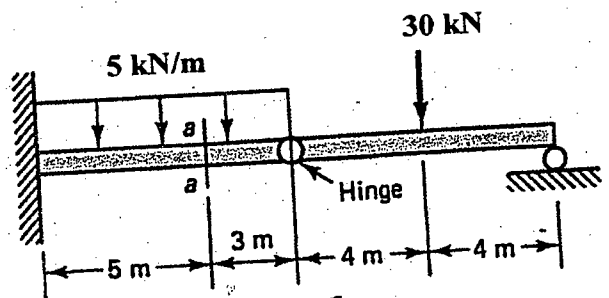


Fig. 8

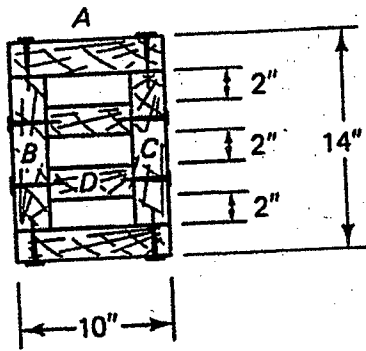


Fig. 9

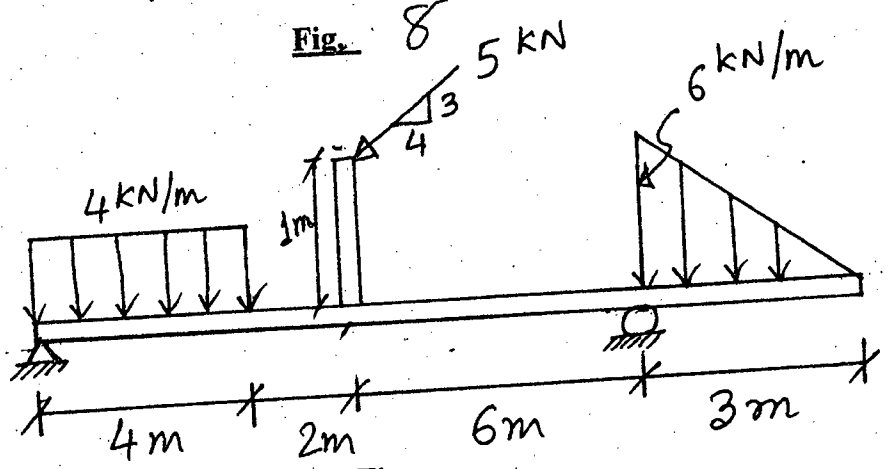


Fig. 10

Sadia / 31.12.12

L-2/T-1/CE

Date : 31/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **CE 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**.

1. (a) Describe the composition and properties of the following minerals. (9)  
(i) Olivine (ii) Orthoclase and (iii) Calcite  
(b) What do you understand by "Cleavage"? Using neat sketches, explain the nature of cleavage of pyroxene mineral. (9)  
(c) Draw a sectional sketch illustrating the way  $\text{SiO}_4$  tetrahedra are bound together in sheets that are joined by K, Na or Ca ions in Mica minerals. (17)
2. (a) Explain how does the Quartz mineral form in nature. Also explain in details the properties of Quartz. What are its hardness and specific gravity? (10)  
(b) Explain using neat sketches how would you determine the magnitude of an earthquake and also the location of its epicenter. (10)  
(c) (i) Using neat sketch explain the nature of seismicity at converging plate boundaries. (7½)  
(ii) Draw a neat sketch showing the distribution of earthquakes associated with divergent plate boundaries. What types of movement along the boundaries generate the earthquakes? Explain in details. (7½)
3. (a) What is meant by the term "Texture" of a rock? What are the different types of textures found in igneous rocks and what are the factors responsible for their development. Explain with examples. (12)  
(b) Write down the names of the principal minerals found in Metamorphic rocks. Using a pressure temperature diagram, show the zones in which the Aluminosilicate minerals Andalusite, Sillimanite and Kyanite are formed. (11)  
(c) Identify the type to which the following rocks belong and describe their composition and properties: (12)  
(i) Phyllite (ii) Breccia  
(iii) Basalt and (iv) Quartzite
4. (a) What is a fault? Draw a neat sketch of a normal fault and identify the hanging wall and foot wall blocks of the fault. (15)  
(b) What is a fold? Using neat sketches describe the following folds. (12)  
(i) Asymmetrical fold (ii) Recumbent fold (iii) Monoclinial fold  
(c) Using neat sketch differentiate between graben and horst. (8)

Contd ..... P/2

**CE 203**

**SECTION – B**

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

5. (a) Write down short notes on the followings: (10)

(i) Hydraulic Radius (ii) Hydraulic Depth

Can the values of these parameters change at the same section of a river? Give examples of real world events and explain when and how these may change.

(b) What is Rational Method? Why is it so prominent among all the methods? What are the assumptions of this method? Explain the assumptions with relevant examples. Explain how to calculate the runoff coefficient of an area on the earth surface which has different land uses within the same basin. (25)

6. (a) Explain the following terms: (10)

(i) Drainage Density (ii) Stream frequency

With Bangladesh context, explain (with diagram) how these parameters can vary among the different regions.

(b) Discuss the variation of various morphological parameters of a river, as it flows along the downstream direction. Explain those variations in the context of Bangladesh. (25)

7. (a) Explain the following terms: (15)

(i) Meandering River (ii) Meander Neck  
(iii) Cut off (iv) Back Swamp

Explain the formation of all these in the context of Bangladesh.

(b) What is river transportation? What are the factors affecting the transportation power of river? How the knowledge of river transportation can help in determining (i) suitable size and (ii) adequate volume of blocks in flood protection embankment design? (20)

8. (a) Differentiate between: (10)

(i) Clastic and nonclastic texture of sedimentary rocks  
(ii) Diagenesis and Metamorphism  
(iii) Slaty and Phyllitic cleavage of metamorphic rocks  
(iv) Contact and Regional Metamorphism

(b) What are the agents of metamorphism? Briefly describe each of them. (10)

(c) Bowen reaction principle explains how an Olivine basaltic magma may solidify as one rock type or may produce several rock types. Explain. (15)

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L-2/T-1/CE

Date : 24/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **MATH 237** (Laplace Transform and Vector Analysis)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION – A**

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

1. (a) Prove that the area of the triangle formed by joining the mid-point of one of the non-parallel sides of a trapezium to the extremities of the opposite side is half of that of the trapezium. (15)  
(b) If the system of vectors  $\mathbf{a}'$ ,  $\mathbf{b}'$ ,  $\mathbf{c}'$ , is reciprocal to the system of vectors  $\mathbf{a}$ ,  $\mathbf{b}$ ,  $\mathbf{c}$ , then prove that any vector  $\mathbf{r}$  is given by  $\mathbf{r} = (\mathbf{r} \cdot \mathbf{a})\mathbf{a}' + (\mathbf{r} \cdot \mathbf{b})\mathbf{b}' + (\mathbf{r} \cdot \mathbf{c})\mathbf{c}'$ . (10)  
(c) Show that  $\nabla \times (\mathbf{A} \times \mathbf{B}) = \mathbf{A} (\nabla \cdot \mathbf{B}) - \mathbf{B} (\nabla \cdot \mathbf{A}) + (\mathbf{B} \cdot \nabla) \mathbf{A} - (\mathbf{A} \cdot \nabla) \mathbf{B}$ . (10)
2. (a) If  $\mathbf{P} = \mathbf{A} \cos kt + \mathbf{B} \sin kt$ , where  $\mathbf{A}$  and  $\mathbf{B}$  are constant vectors and  $k$ , a constant scalar, show that  $\frac{d^2 \mathbf{P}}{dt^2} + k^2 \mathbf{P} = 0$ . (10)  
(b) Show that acceleration of a particle along a curve is a vector in the plane of the tangent and the normal with  $\frac{dv}{dt}$  and  $v^2 \kappa$  as its tangential and normal components respectively. (15)  
(c) Solve the vector equation  $\mathbf{a} \times \mathbf{x} + \mathbf{a} (\mathbf{a} \cdot \mathbf{x}) + \mathbf{b} = 0$  for the vector  $\mathbf{x}$ . (10)
3. (a) Find the acute angle between the surfaces  $xy^2z = 3x + z^2$  and  $3x^2 - y^2 + 2z + 1 = 0$  at  $(1, -2, 1)$ . (10)  
(b) Show that the vector angular velocity of a uniformly rotating body about an axis is half of the curl of the linear velocity. (15)  
(c) Find the direction along which the directional derivative of  $Q = x^2yz^3$  at  $(2, 1, -1)$  is the greatest. Determine the greatest value as well. (10)
4. (a) Show that the vector field  $\mathbf{F} = (x^2 - yz) \mathbf{i} + (y^2 - zx) \mathbf{j} + (z^2 - xy) \mathbf{k}$  is irrotational. Find a scalar function  $\phi$  such that  $\mathbf{F} = \nabla \phi$  and given that  $\phi(1, -1, 0) = 8$ . (15)  
(b) If  $\mathbf{F} = 2y\mathbf{i} - z\mathbf{j} + x^2\mathbf{k}$  and  $S$  is the surface of the parabolic cylinder  $y^2 = 8x$  in the first octant bounded by the planes  $y = 4$  and  $z = 4$ , evaluate  $\iint_S \mathbf{F} \cdot \mathbf{n} dS$ . (20)

Contd ..... P/2

## MATH 237

### SECTION - B

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

5. (a) State Stoke's theorem. Verify this theorem for  $\underline{F} = (2x - y)\mathbf{i} - yz^2\mathbf{j} - y^2z\mathbf{k}$ , where S is the upper half surface of the sphere  $x^2 + y^2 + z^2 = 1$  and C is the boundary of S. (20)

- (b) State Green's theorem for the plane. Applying Green's theorem, evaluate (15)

$$\oint_C [(3x^2 - 8y^2)dx + (4y - 6xy)dy]$$

where C is the region bounded by the curves  $y^2 = -x$  and  $y = -x^2$ .

6. (a) Find  $L \left\{ \frac{\cos at - \cos bt}{t} \right\}$ . (12)

- (b) Show that  $\text{Si}(\infty) = \frac{\pi}{2}$ . (11)

- (c) Define finite unit impulse  $\delta(t - t_0)$ . Find the Laplace transform of  $\delta(t - t_0)$ . (12)

7. (a) Evaluate  $L^{-1} \left\{ \frac{5s^2 - 15s - 11}{(s + 1)(s - 2)^3} \right\}$  by Heaviside's expansion formula. (18)

- (b) State Convolution theorem. Use this theorem to evaluate  $L^{-1} \left\{ \frac{8}{(s^2 + 1)^3} \right\}$ . (17)

8. (a) Solve  $Y''(t) + Y(t) = 2\sin t$ ,  $Y(0) = 0$ ,  $Y'(0) = -1$  by using Laplace transform. (11)

- (b) A particle of mass 3 gms moves on the x-axis and is attracted towards a fixed point in its path with a force whose numerical value is  $12x$ . Assuming that the particle is initially at rest at  $x = 5$ , determine the position of the particle at any time t (12)

(i) when there is no other force

(ii) when there is a dumping force whose numerical value is 6 times the instantaneous velocity. Use Laplace transform.

- (c) Evaluate  $\int_0^\infty \frac{\sin tx}{x(x^2 + a^2)} dx$  by using Laplace transform. (12)