

SECTION – AThere are **FIVE** questions in this Section. Answer any **FOUR**.

1. Determine the reactions and draw axial force, shear force and bending moment diagrams for the beam shown in Fig. 1. Show the location and magnitude of maximum moment in the moment diagram. (26 ¼)

2. A cylindrical steel pressure container 400 mm in diameter with a wall thickness of 20 mm, is subjected to an internal pressure of 5.5 MN/m².
 - (a) Calculate the longitudinal and transverse stresses in the steel. (10)
 - (b) To what value may the internal pressure be increased if the stress in steel is limited to 150 MN/m²? (6 ¼)
 - (c) Determine the change in length and diameter of the container for the second case (i.e. case b). Given: Original Length of the container = 6 metre. (10)

3. For the planar structure shown in Fig. 2, find the reactions and determine the axial forces, shear forces and bending moments at sections a–a and b–b. Also draw the bending moment diagram for the beam AB. (20+6 ¼)

4. A beam is made up of four 50 × 100 mm full sized timber pieces that are glued to a 25 mm × 500 mm plywood web as shown in Fig. 3. Determine the maximum allowable shear and the maximum allowable bending moment that this section can carry. Allowable flexural stress is 10 MPa and allowable shear stress in the plywood is 0.6 MPa. Shearing stress in the glued joint is restricted to 0.3 MPa. All dimensions in the figure are in mm. (26 ¼)

5. (a) Show that for standard channel section of uniform thickness (t), flange width (b) and web depth (h), the shear centre can be expressed as $e = \frac{b}{2 + h/3b}$. (12)

 (b) Determine the numerical value of the shear centre location (e) for a channel for which b = 120 mm, h = 300 mm and t = 10 mm. Also, find the value of shear force (V) that can be carried by this section if maximum allowable shear stress is 195 MPa. (14 ¼)

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SECTION – B

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

6. To support a load of $P = 250$ kN, determine the area required for member AD of the tripod shown in Fig.-4. Neglect the weight of the structure and assume that the joints are pin connected. No allowance has to be made for threads. Allowable stresses in tension and compression are 140 MPa and 100 MPa respectively. All dimensions are in meters. (26 $\frac{1}{4}$)
7. (a) The rigid bars AB and CD shown in Fig.-5 are supported by two pins at A and C and the two rods made of aluminum and steel. Determine the maximum force P that can be applied so that vertical movement at D is limited to 5 mm. (10 $\frac{1}{4}$)
- (b) A 10-mm-thick, low-alloy-steel plate 180 mm wide 2000 mm long is subjected to a set of uniformly distributed frictional forces along its two edges as shown in Fig.-6. If the total decrease in the transverse 180 mm dimension at section a–a due to applied load is 12×10^{-3} mm, what is the total elongation of the bar in the longitudinal direction? Let $E = 200$ GPa and $\nu = 0.25$. (16)
8. A small steel T beam is used in an inverted position to span 400 mm. If to the application of the forces shown in Fig. 7, the longitudinal gage at A registers a compressive strain of 40×10^{-5} , compute to magnitude of the applied forces. Let $E = 200$ GPa. (26 $\frac{1}{4}$)
9. As the screw of a large steel C camp, such as shown in Fig.-8, is tightened upon an object, the strain in the horizontal direction due to bending only is measured by a strain gage at point B. If a strain of 800×10^{-3} in/in is noted, what is the force on the screw corresponding to the strain? Let $E = 30 \times 10^6$ psi. (26 $\frac{1}{4}$)
10. Consider the stepped shaft shown in Fig.-9 rigidly attached at both ends, draw the angular twist diagram when the two torques at B and D are applied. Let $G = 80$ GPa. (26 $\frac{1}{4}$)
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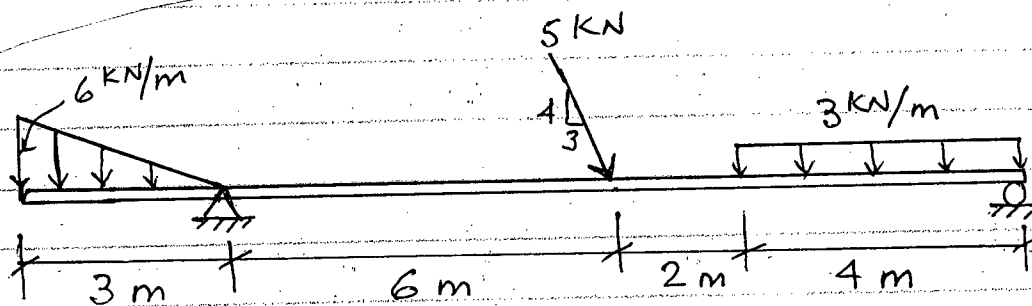


FIG. 1

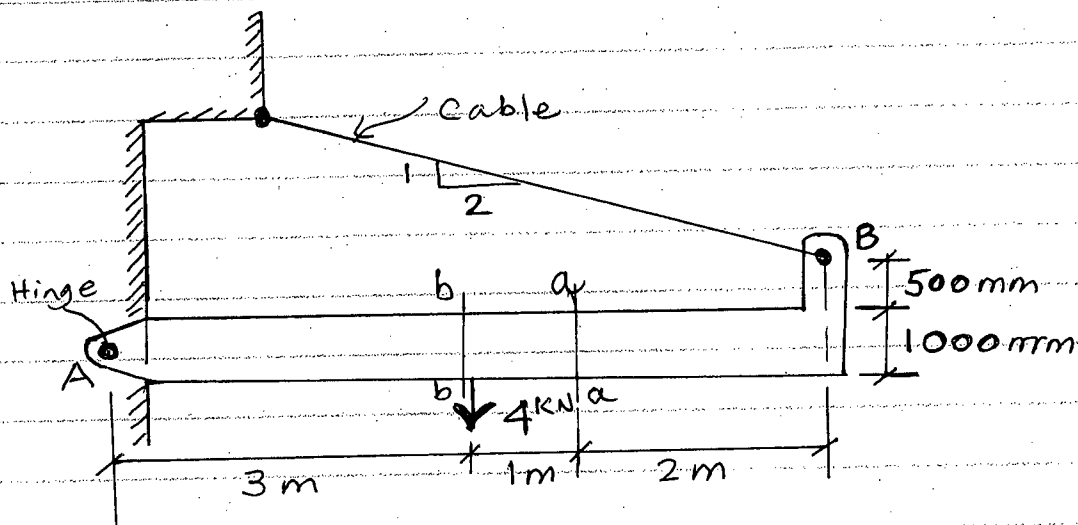


FIG. 2

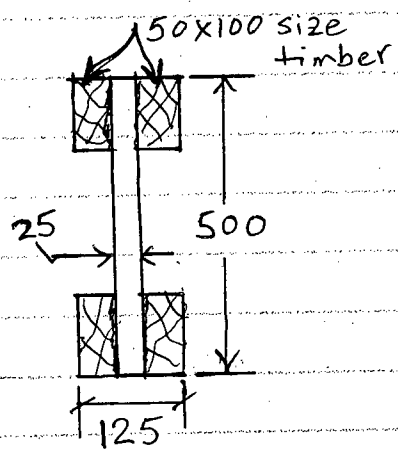


FIG. 3

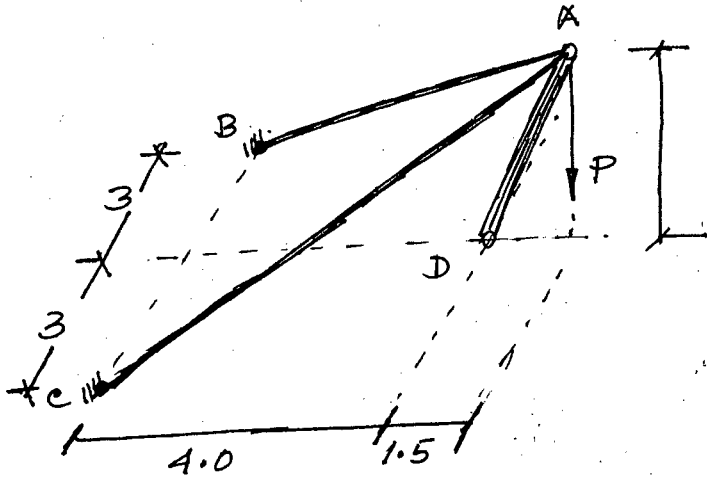


Fig 4 ~~for Q7~~

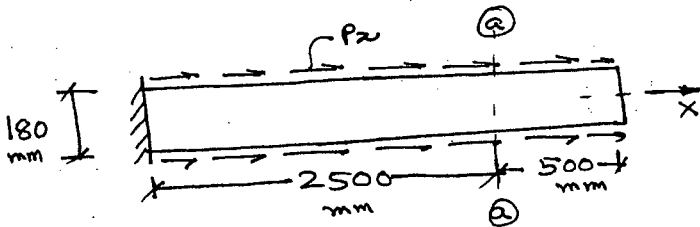


Fig 6 ~~for Q7(b)~~

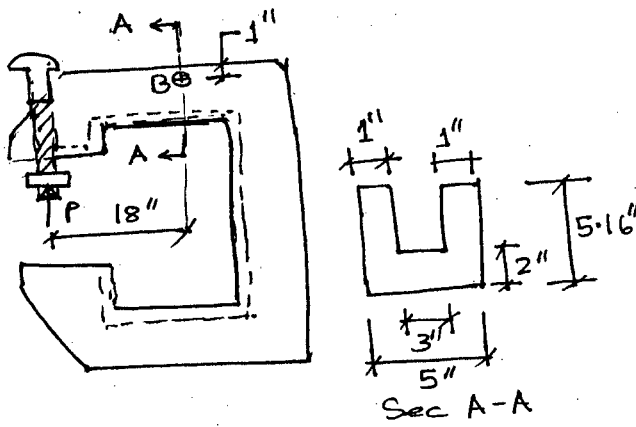


Fig 8 ~~for Q9~~

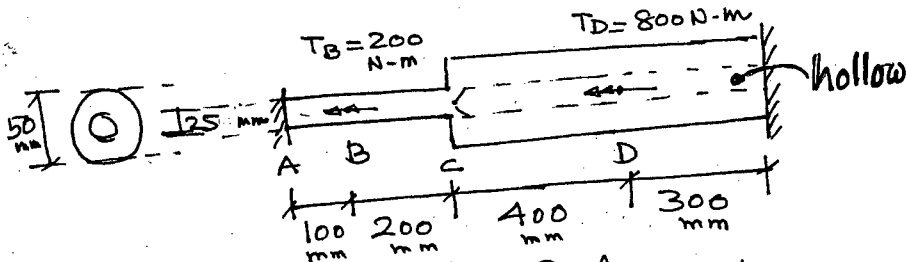


Fig 9 ~~for Q10~~

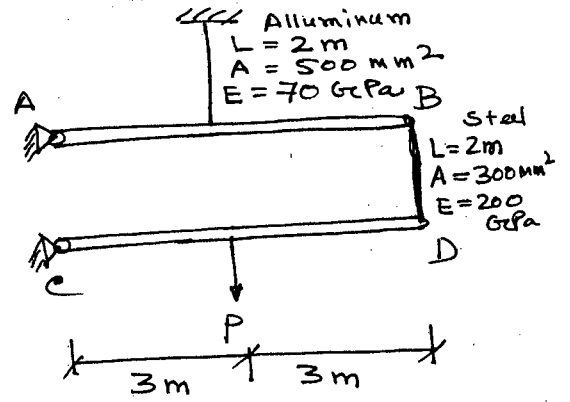
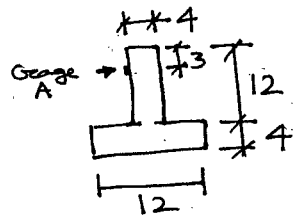
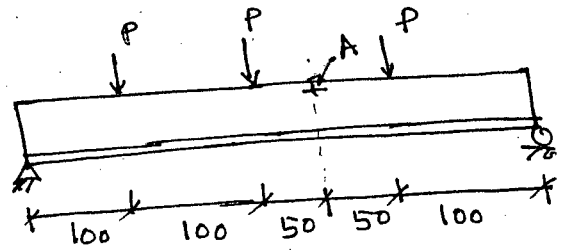


Fig 5 ~~for Q7(a)~~



all dimensions are in mm

Fig 7 ~~for Q8~~

SECTION – A

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

1. Following materials were used to produce a batch of concrete. Total moisture content of fine aggregate and coarse aggregate is 3.5% and 0.5% respectively. Absorption capacity of aggregates is 1.5%. Maximum size of coarse aggregate is 20 mm. (26.25)

- (a) What is the volume of compacted concrete if the air content is 2%.
- (b) Calculate the w/c ratio.
- (c) Calculate the density of compacted concrete?
- (d) What is the expected slump range of the batch of concrete?
- (e) What is the expected design compressive strength of the concrete?

materials	Weight(kg)	Specific Gravity
Water	200	1.00
Cement	500	3.15
Fine Aggregate	600	2.60 (bulk OD)
Course Aggregate	1100	2.60 (bulk OD)

2. (a) What is the spalling of concrete? How does it occur? Illustrate with neat sketches how an spalled area of a floor slab can be repaired with ferrocement? (13)

- (b) Explain why dampness of an exterior wall may occur. Do you think such dampness problems of walls may be corrected with ferrocement? Why? (13.25)

3. (a) Explain how reinforcement inside a reinforced concrete member may be protected from corrosion? (13)

- (b) What is additional /sacrificial thickness? Why is it provided? (13.25)

4. (a) "Compressive strength, w/c ratio and workability of concrete are related" – Explain. (13)

- (b) Draw a neat sketch of timber section and show different parts of it. Differentiate between heart wood and sap wood. Define hard wood and soft wood. (13.25)

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5. The volumetric ratio and w/c ratio of concrete is given below, find the masses of ingredients required for 1m^3 concrete. How many bags of cement required for 1m^3 concrete? Find the loose bulk volume of fine and coarse aggregate in cft for 1m^3 concrete. Assume that there is no air content in concrete.

Volumetric ratio = 1 : 1.2 : 2

w/c = 0.45

Specific gravity of cement = 3.15

bulk specific gravity of fine aggregate = 2.65 (SSD)

bulk specific gravity of coarse aggregate = 2.55 (SSD)

compacted bulk density of cement = 1410 kg/m^3

Loose bulk density of fine aggregate = 1350 kg/m^3

Loose bulk density of coarse aggregate = 1450 kg/m^3

6. (a) Define high strength and normal strength concrete according to ACI. Why is cube strength greater than cylinder strength? (10)
- (b) What is maturity rule of concrete? What is the limitation of maturity rule? (6.25)
- (c) Why is compressive strength of concrete inversely proportion to w/c ratio? (10)

SECTION – B

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

7. (a) Why is gypsum used in OPC manufacturing? How does it serve the intended propose in OPC? (12 $\frac{1}{4}$)
- (b) State the role of hydration in developing cement properties i.e., setting and hardening. How is hydration related to curing? Mention the curing periods for (i) Beam, (ii) Column and (iii) Partition wall. Do they vary? Why? (14)
8. (a) How can you obtain fat lime from its natural source? Write down the properties of hydraulic lime. (12 $\frac{1}{4}$)
- (b) You are given three sand samples with different FM, such as: (i) FM = 0.21, (ii) FM = 0.95 and (iii) FM = 2.90. Which of the above sand sample will be suitable for (i) Plastering on R.C.C. (ii) Plastering on masonry wall, (iii) Concreting of column and (iv) Concreting of bored pile? Justify your answer. (14)
9. (a) Describe the criteria for proportioning cement ingredients. Name the mineral ingredients of cement. (12 $\frac{1}{4}$)

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Contd ... Q. No. 9

(b) State the limitations of using sea sand in concrete/mortar. Write down the functions of sand in concrete/mortar. (14)

10. (a) Classify brick according to BDS 208 : 2002 specification. Mention the limiting values of (i) Crushing strength test, (ii) absorption capacity test for the various grades of brick. (12 $\frac{1}{4}$)

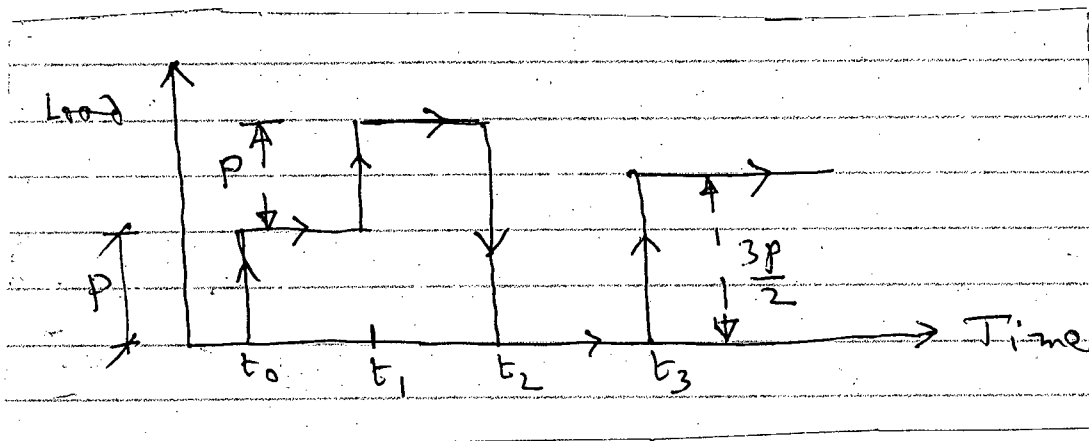
(b) State the importance of using Low heat cement in mass concreting. How does this cement serve the intended purpose? How does it differ from OPC in mineral ingredients (state the comparison in percentage)? (14)

11. (a) Describe the characteristics of the strain components of an elasto - visco- plastic material with neat sketches. (14 $\frac{1}{4}$)

(b) Illustrate the steps involved for obtaining isochronous load-strain curves for an elasto - plastic material. Explain the significance of such load - strain curves. (14)

12. (a) For the loading history shown below, draw the likely strain response of (i) plastic material and (ii) an elasto - plastic material. Assume equal time intervals, i.e., (12 $\frac{1}{4}$)

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



(b) The results of sieve analysis of a sand sample is as follows: (14)

Sieve No. (Size, mm)	% Finer
# 8 (2.36 mm)	75.0
# 16 (1.18 mm)	75.0
# 30 (0.60 mm)	45.0
# 50 (0.30 mm)	15.0
# 100 (0.15 mm)	1.5

Determine whether the sand can be used for making ferrocement as per BNBC (1993) guideline.

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 m³ 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	$1.10f'_c + 700$

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2010-2011

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 – AThere are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) What is the basic difference between variable costing and absorption costing? (5)
- (b) Consider the following data relating to stratford manufacturing company for the period ended on December 31, 2009. (18 $\frac{1}{3}$)

Cost Data (Tk):

Variable manufacturing costs:

Direct materials	25
Direct labour	12
Variable manufacturing overhead	13
Variable selling and administrative overhead	10
Fixed manufacturing overhead	250,000
Fixed selling and administrative overhead	150,000

Production and Sales Data:

Units produced	25,000 units
Units sold	20,000 units
Unit selling price	Tk. 100

Required:

- (i) Compute unit product cost under absorption costing and variable costing.
- (ii) Prepare income statements under absorption costing and variable costing.
- (iii) Reconcile the amount of net income under two methods and interpret the situation.
2. Stealtech Inc. produces memory enhancement kits for fax machines. Sales have been very erratic in some months showing a profit and in some months showing a loss. The company's income statement for the most recent month is given below: (23 $\frac{1}{3}$)

Sales (12,400 units @ Tk. 20 per unit)	Tk 248,000
Less: Variable costs	189,000
Contribution margin	59,000
Less: Fixed cost for the period	60,000
Net operating loss	Tk 1,000

Contd P/2

HUM 353 (CE)

Contd ... Q. No. 2

Required:

- (i) Compute the company's CM ratio and its break-even point in both units and taka.
- (ii) The sales manager feels that Tk. 8,000 increase in the monthly advertising budget, combined with an intensified effort by the sales staff, will result in a Tk. 70,000 increase in monthly sales. If the sales manager is right, what will be the effect on the company's monthly net operating income or loss.
- (iii) The president is convinced that a 10% reduction in the selling price, combined with an increase of Tk. 15,000 in the monthly advertising budget, will cause unit sales to double. What will the new income statement look like if these changes are adopted?
- (iv) Refer to the original data. The company's advertising agency thinks that a new package would help sales. The proposed new package would increase packaging costs Tk. 0.50 per unit. Assuming no other changes, how many units would have to be sold each month to earn a profit of Tk. 5,000? What will be the new break-even point in Tk. sales?
- (v) Assume that the operating results for the last year were as follows:

Sales	Tk 360,000
Less: Variable costs	162,000
Contribution margin	<u>198,000</u>
Less: Fixed cost	180,000
Net operating income	<u>Tk 36,000</u>

- * What will be the degree of operating leverage in this situation?
- * The president expects sales to increase by 15% next year. By how much should net operating income increase (use degree of operating leverage)?
- * Verify your answer by preparing income statement.

3. (a) What do you understand by mixed cost and cost formula? (3 1/3)
- (b) What is the major disadvantage of high and low point method? (2)
- (c) Speedy Parcel Service operates a fleet of delivery trucks in a large metropolitan area. A careful study by the company's cost analyst has determined that if a truck is driven 120,000 miles during a year, the average operating cost is Tk. 11.6 per mile. If a truck is driven only 80,000 miles during a year, the average operating cost increases to Tk. 13.6 per mile. (14)

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HUM 353 (CE)

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

Required:

- (i) Using the high-low method, determine the variable and fixed cost elements of the annual cost of truck operation.
- (ii) Express the variable costs in the form $Y = a + bx$.
- (iii) If a truck is driven 100,000 miles during a year, what total cost would you expect to be incurred?
- (d) Neptune Rentals offers a boat rental service. Consider the following costs of the company over a relevant range of 5,000 to 20,000 hours of operating time for its boats:

(4)

	Hours of Operating Time			
	5000	10,000	15,000	20,000
Total costs (Tk):				
Variable costs	20,000	?	?	?
Fixed costs	180,000	<u>?</u>	<u>?</u>	<u>?</u>
Total costs	200,000	<u>?</u>	<u>?</u>	<u>?</u>
Cost per hour (Tk):				
Variable costs	?	?	?	?
Fixed costs	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>
Total costs	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>

Required:

Compute the missing amounts, assuming that implied cost behavior patterns remain unchanged over the relevant range of 5,000 to 20,000 hours.

4. (a) Name the three types of inventories that appear on a manufacturer's balance sheet. Define each of them with an example.

(4 1/3)

- (b) Various cost and sales data for Meriwell Company for the just ended year are as follows:

(19)

	<u>Tk.</u>
Selling expenses	140,000
Beginning raw materials	90,000
Ending raw materials	60,000
Plant utilities	36,000
Direct labour	300,000
Depreciation, plant equipment	162,000

Contd P/4

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Contd ... Q. No. 4(b)

Purchase of raw materials	750,000
Sales	30,00,000
Insurance for factory	40,000
Indirect labour	150,000
Maintenance for plant equipment	87,000
Legal fees	50,000
Directors fees	130,000
General expenses	40,000
Advertisement expenses	45,000
Sales managers salary	20,000
Beginning work in process	180,000
Ending work in process	100,000
Beginning finished goods	260,000
Ending finished goods	210,000
Cleaning supplies, factory	7,000
Rent ($\frac{2}{3}$ for factory, $\frac{1}{3}$ for office)	120,000
Gas and Water, factory	2,500
Carriage outwards	6,000
Carriage inwards	7,000

Required:

- (i) Prepare a cost of goods sold statement
- (ii) Prepare an income statement.

SECTION – B

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

5. (a) For each of the following items before adjustment, indicate the type of adjusting entry.

(4 $\frac{1}{3}$)

- (i) Prepaid Expenses.
- (ii) Un-earned Revenues.
- (iii) Accrued Revenues.
- (iv) Accrued Expenses.

Contd P/5

HUM 353 (CE)

Contd ... Q. No. 5

(b) The trial balance of Union Capital Ltd. for the month of March 31, 2011 before adjustment is given below:

(19)

Union Capital Ltd

Trial Balance

March 31, 2011

Account Titles	Debit (Tk.)	Credit (Tk.)
Cash	2000	
Supplies	5000	
Prepaid Insurance	12000	
Equipment	40000	
Accumulated depreciation		2,000
Notes payable		20,000
Unearned Rent		9,000
Interest expenses	2000	
Capital		30,000
Total	<u>61000</u>	<u>61000</u>

Other data:

- Insurance Policy is for 2 years.
- Supplies used during March Tk. 4000.
- Equipment is depreciated Tk. 2400 per year.
- Tk. 5,000 of unearned revenue have been earned.
- Service provided but not recorded Tk. 3000.

Required:

- (i) Prepare adjusting entries for March, 2011
- (ii) Prepare adjusted Trial Balance.

6. Salma Inc. was formed on January 1, 2011. The Trial balance for Salma Inc. at March 31, 2011 is given below—

Salma Inc.

Trial Balance

For the Quarter ended March 31, 2011

Account Titles	Debit (Tk.)	Credit (Tk.)
Cash	40,000	
Accounts Receivable	43,000	
Prepaid Insurance	12,000	

Contd P/6

HUM 353 (CE)

Contd ... Q. No. 6

Supplies	5,000	
Equipment	150,000	
Accounts payable		15,000
Notes payable		100,000
Capital		100,000
Drawings	20,000	
Unearned Revenue		20,000
Salaries expenses	1,000	
Interest expenses	15,000	
Accumulated Depreciation		10,000
Rent expense	9,000	
Service Revenue		50,000
Total	<u>295000</u>	<u>295000</u>

Required:

(a) Prepare—

(17)

- (i) Income Statement
- (ii) Owner's Equity Statement
- (iii) Classified Balance Sheet

(Assume 50% of the notes payable will be paid within the year).

(b) Compute the following ratio's—

(6 ⅓)

- (i) Current Ratio,
- (ii) Quick ratio,
- (iii) Debt to Equity ratio.

7. (a) Identify the basic steps in an accounting recording cycle.

(3 ⅓)

(b) Arham Inc. was formed on December 1, 2011. The following transactions took place during the month.

(20)

- December-1 Owner invested Tk. 200,000 cash in the business.
- December-1 Hired two employees to work in the warehouse. They will each paid a salary of Tk. 3,000 per month.
- December-5 Signed a 3-year rental agreement on a Warehouse; paid Tk. 50,000 cash in advance for the first year.
- December-10 Purchased equipment costing Tk. 70,000; A cash payment of Tk. 30,000 was made.

Contd P/7

HUM 353 (CE)

Contd ... Q. No. 7(b)

- December-15 Purchased basic office supplies for Tk. 1,000 cash.
- December-20 Total revenues earned were Tk. 50,000; Tk. 20,000 cash and Tk. 30,000 on account.
- December-25 Paid Tk. 800 to accounts payable due for supplies.
- December-28 Received Tk. 7,000 from customers in payment of accounts receivable.
- December-30 Received utility bills in the amount of Tk. 400, to be paid next month.
- December-31 Paid the monthly salaries of the two employees, totaling Tk. 6,000.

Required:

- (i) Prepare journal entries to record the above events listed.
- (ii) Prepare the "Cash Account".
8. (a) Discuss the various parts of a classified Balance Sheet. (3 1/3)
- (b) Mr. Hasan started his own business on July 1, 2011. The following transaction occurred during the month of July. (20)
- July-1 Invested Tk. 50,000 cash to start his business
- July-5 Purchased a building for Tk. 30,000 cash for use in business.
- July-8 Purchased supplies on account Tk. 5,000
- July-12 Billed customer Tk. 1,800 for service performed.
- July-15 Ordered for a delivery van Tk. 10,000.
- July-20 Paid Tk. 400 for advertising.
- July-25 Received Tk. 1,000 cash from customer billed on July-12.
- July-28 Paid creditor Tk. 4,000 related to the transaction on July-8.
- July-30 Withdraw Tk. 1,000 cash for personal use by owner.
- July-31 Paid Tk. 1,500 for salaries.

Required:

Prepare a tabular analysis of the above transactions.

SECTION – AThere are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Show that **a**, **b** and **c** are linearly independent. Express **d** as a linear combination of **a**, **b** and **c**, when **a**, **b**, **c** and **d** are (4, 5, 1), (0, -1, -1), (3, 9, 4) and (-4, 4, 4) respectively. (18)
- (b) By vector method find the length of the perpendicular from P: (x_0, y_0, z_0) upon the line joining the points A: (a_1, a_2, a_3) and B: (b_1, b_2, b_3). (10)
- (c) Prove that $[\mathbf{a} \times \mathbf{p}, \mathbf{b} \times \mathbf{q}, \mathbf{c} \times \mathbf{r}] + [\mathbf{a} \times \mathbf{q}, \mathbf{b} \times \mathbf{r}, \mathbf{c} \times \mathbf{p}] + [\mathbf{a} \times \mathbf{r}, \mathbf{b} \times \mathbf{p}, \mathbf{c} \times \mathbf{q}] = 0$ (7)
2. (a) Find T, N, B, κ , τ and the equation of fundamental planes of the space curve $x = t, y = 3t^2, z = t^3$ at any point and at $t = 0$. (15)
- (b) Evaluate $\frac{d^2}{dt^2} \left\{ \mathbf{r} \times \left(\frac{d\mathbf{r}}{dt} \times \frac{d^2\mathbf{r}}{dt^2} \right) \right\}$. (8)
- (c) Find the equations of the tangent line and normal plane to the curve $x^2 + y^2 + z^2 = 1, x + y + z = 1$ at the point (1, 0, 0). (12)
3. (a) A particle moves so that its position vector is given by $\mathbf{r} = \cos\omega t\mathbf{i} + \sin\omega t\mathbf{j}$ where ω is constant. Show that (14)
 - (i) the velocity **v** is perpendicular to **r**.
 - (ii) the acceleration is directed towards the origin.
 - (iii) $(\mathbf{r} \times \mathbf{v})$ is constant.
- (b) Show that the vector field $\mathbf{F} = 3x^2y\mathbf{i} + (x^3 + 2yz)\mathbf{j} + y^2\mathbf{k}$ is irrotational. Find the amount or work done in moving an object in this field from (1, -2, 1) to (3, 1, 4). (14)
- (c) Show that $\nabla \cdot (\mathbf{A} \times \mathbf{B}) = \mathbf{B} \cdot (\nabla \times \mathbf{A}) - \mathbf{A} \cdot (\nabla \times \mathbf{B})$. (7)
4. (a) Define directional derivative and normal derivative. Find the direction along which the directional derivative of $\phi = 2xz - y^2$ at the point (1, 3, 2) is the greatest. Determine the greatest value as well. (17)
- (b) Evaluate: $\int \int_S \mathbf{F} \cdot d\mathbf{S}$ where $\mathbf{F} = y^2z^2\mathbf{i} + z^2x^2\mathbf{j} + x^2y^2\mathbf{k}$ and S is the surface of the sphere $x^2 + y^2 + z^2 = 1$ above the xy-plane. (18)

MATH 237**SECTION – B**

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

5. (a) Find the total work done in moving a particle in a force field given by

$$\vec{F} = 3xy \hat{i} - 5z \hat{j} + 10x \hat{k} \text{ along the curve } x = t^2 + 1, y = 2t^2, z = t^3 \text{ from } t = 1 \text{ to } t = 2 \quad (15)$$

- (b) Verify the Gauss divergence theorem for the function $\vec{F} = y\hat{i} + x\hat{j} + z^2\hat{k}$ over the cylinder region S bounded by $x^2 + y^2 = a^2$, $z = 0$ and $z = h$. (20)

6. (a) If $L\{F(t)\} = f(s)$, then prove that $L\left\{\frac{F(t)}{t}\right\} = \int_s^\infty f(u)du$. (10)

- (b) Find $L\{Ei(t)\}$ (10)

- (c) Prove that $L\{\cos t \sin t - \sin t \cos t\} = \frac{\log s}{s^2 + 1}$ (15)

7. (a) Evaluate: $L^{-1}\left\{\frac{6s+4}{s^2-4s+20}\right\}$ (11)

- (b) Evaluate: $L^{-1}\left\{\frac{6s^2+22s+18}{s^3+6s^2+11s+6}\right\}$ (12)

- (c) Show that $\frac{1}{\sqrt{s-1}} = \frac{1}{s-1} + \frac{1}{\sqrt{s}}\left(1 + \frac{1}{s-1}\right)$ and hence find $L^{-1}\left\{\frac{1}{\sqrt{s-1}}\right\}$. (12)

8. (a) Solve the following differential equations by the Laplace transform (10+15=25)

(i) $Y''(t) + Y'(t) - 2Y(t) = \sin t$, $Y(0) = Y'(0) = 0$

(ii) $Y''(t) - tY'(t) + Y(t) = 1$, $Y(0) = 1$, $Y'(0) = 2$.

- (b) Evaluate $\int_0^\infty e^{-x^2} dx$ by using Laplace transform. (10)
