

Extra

L-2/T-1/CE

Date : 12/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2012-2013

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

Full Marks: 210

Time : 3 Hours

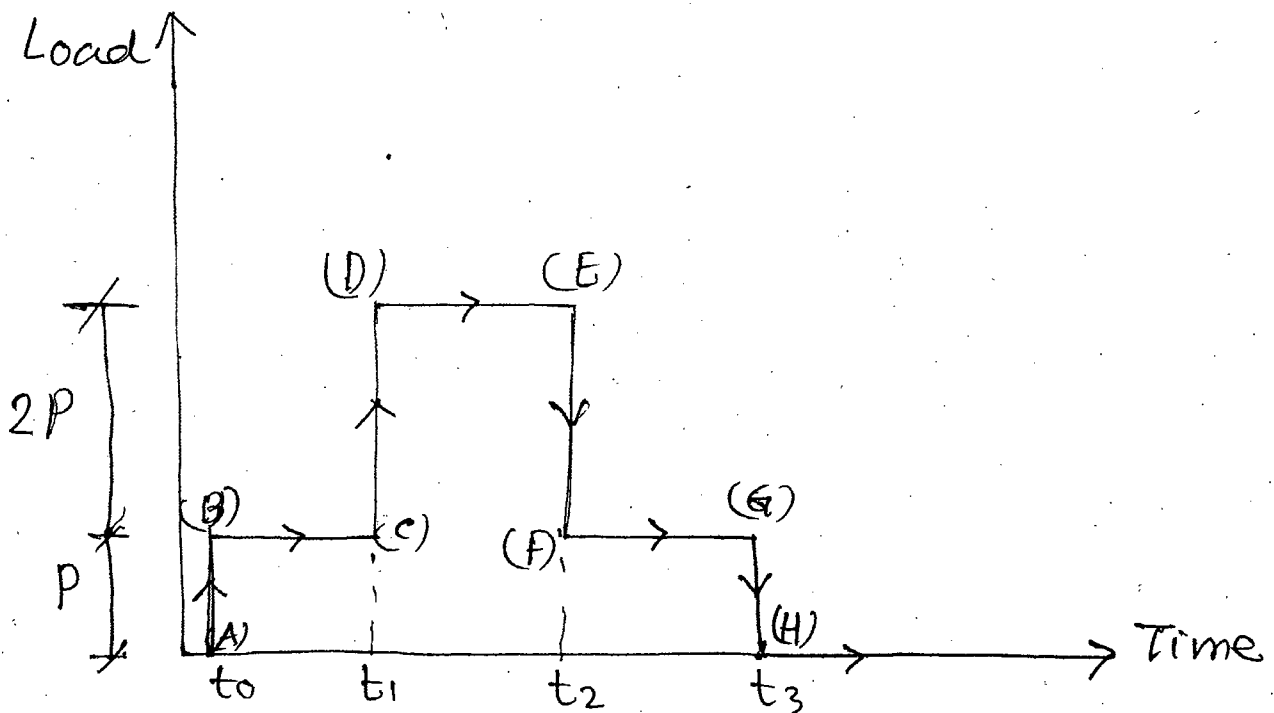
USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION - A

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

1. (a) Describe the characteristics of (i) elastic strain, (ii) plastic strain and (iii) viscous strain. (10)
- (b) Show (i) proportional limit, (ii) elastic limit, (iii) yield point, (iv) ultimate strength and (v) plastic flow zone on a typical stress-strain curve of steel. Explain the significance of each of these. (10)
- (c) For the following loading sequence applied to an (i) elasto-plastic material and (ii) on an elasto-visco-plastic material, plot the probable response or variation of strain with time. (15)



2. (a) Describe how spalling of concrete occurs. Why is this harmful for the RC members? (10)
- (b) Describe with neat sketches how ferrocement can be used to repair spalled concrete of a floor slab. Why do you think such repair would reduce chances of further spalling in future? (15)

14 18

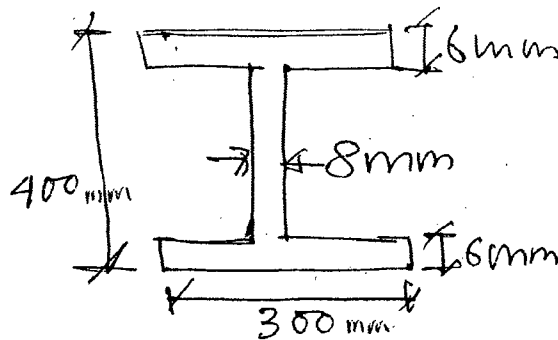
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Contd... Q. No. 2

(c) What is 'sacrificial thickness' of a steel member? Explain. (10)

Following section of a H-pile is required for a jetty construction. If the rate of corrosion of the steel section in the given environment is 0.0025 mm/year and the service life of the pile is 100 yrs, what section should be provided in the beginning?



3. (a) Define soft wood, hard wood, heart wood and sap wood. (10)

(b) What are the differences between fiber board and plywood? (10)

(c) Write down the applications of FRP and CRP. (5)

(d) Define well graded, gap graded and uniformly graded aggregate showing typical gradation curves. Why is grading important for making concrete? (10)

4. (a) Why does compressive strength of concrete decreases with increasing water-cement ratio? (10)

(b) A mix design proposed following batch masses for making 1 m³ concrete. Adjust the batch masses for site condition. Calculate water-cement ratio and expected mean strength of concrete. (15)

Ingredient	Mass (kg) (SSD)	Absorption capacity (%)	Moisture content in field (%)
Water	180	N/A	N/A
Cement	400	N/A	N/A
Fine Aggregate	790	1.5	4.0
Coarse Aggregate	1030	0.8	0.4

(c) An aggregate has following properties. Determine absorption capacity of the aggregate. Calculate inter-particle void and permeable pore volume at 1 m³ dry rodded bulk volume of aggregate. Don't use any formula. (10)

Property	Value
Bulk specific gravity (O-D basis)	2.50
Apparent specific gravity (O-D basis)	2.60
Dry rodded bulk density	1600 kg/m ³

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SECTION - B

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

5. (a) Which tests do you perform using Vicat Needle Apparatus? Define each tests mentioning needle/plunger size, penetration depth in the cement paste and time intervals to achieve the deterministic state of cement paste. (10)
- (b) What is calcium sulfo-aluminate? How is it produced in cement? State its role. (3+3+4)
- (c) What is the difference between air-entrained and non-air-entrained concrete? Why is compressive strength of concrete cylinder function of h/d ratio? (10+5)
6. (a) Define hydraulicity? Why is it important for a cementing material? What else can you do if a lime is found to be devoid of this property? State the factors affecting hydraulicity of lime. (3+2+3+5)
- (b) Why is curing important in cement product? Why is curing of column continued for longer period than that of masonry work? (8)
- (c) State the precautionary measures to be undertaken while using mortars. (6)
- (d) Define bulking of sand. How does it occur? What is its importance in concrete mix design? (8)
7. (a) State the properties of S-grade brick. (6)
- (b) What do you mean by dampness? Why does it occur in a masonry wall? Which test do you perform on brick to control this? Describe the test briefly. State the specification of BDS-208:2002 standard regarding this test for various grades of brick. (2+3+1+5+3)
- (c) Describe the operations involved in brick-clay preparation. Why is drying and preheating of raw brick necessary? (4+3)
- (d) Differentiate between Sea sand and River sand as fine aggregate of concrete. (8)
8. (a) Design compressive strength of pile cap and pile is 4000 psi. Required slump value for pile cap concrete and pile concrete is 50 - 100 mm and 150 - 200 mm respectively. What would be the preliminary mix proportions of concrete for pile and pile cap. Estimate the cement (bag), fine aggregate (cft) and coarse aggregate (cft) required for 1 m³ concrete for pile and pile cap separately. Assume reasonable values for missing data. Use attached tables where necessary (20)
- (b) How are compressive strength, water-cement ratio and workability related? (10)
- (c) How can you ensure durability of concrete? (5)
-

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.	FM of fine aggregate			
	2.40	2.60	2.80	3.00
mm				
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	$1.10f'_c + 700$

SECTION – A

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

Symbols used have their usual meaning.

1. (a) Examine whether the vectors $(5, 6, 7)$, $(7, -8, 9)$ and $(3, 20, 5)$ are linearly independent or dependent. If dependent find a linear relation between them. (15)
- (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 $[\mathbf{a} \times \mathbf{p}, \mathbf{b} \times \mathbf{q}, \mathbf{c} \times \mathbf{r}] + [\mathbf{a} \times \mathbf{q}, \mathbf{b} \times \mathbf{r}, \mathbf{c} \times \mathbf{p}] + [\mathbf{a} \times \mathbf{r}, \mathbf{b} \times \mathbf{p}, \mathbf{c} \times \mathbf{q}] = 0$ (10)
2. (a) Define **T**, **N**, **B**, κ and τ and hence derive the Frenet-Serret formulae. (15)
- (b) If $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ and $r = |\mathbf{r}|$, find $\nabla^2 r^n$ and show that $\nabla^2 \left(\frac{1}{r} \right) = 0$. (10)
- (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 $(1, 0, 0)$. (10)
3. (a) Find the values of the constants a, b, c so that the directional derivative of $\phi = axy^2 + byz + cz^2x^3$ at $(1, 2, -1)$ has a maximum magnitude 64 in the direction parallel to z-axis. (14)
- (b) Show that the vector field $\mathbf{F} = 3x^2y\mathbf{i} + (x^3 + 2yz)\mathbf{j} + y^2\mathbf{k}$ is conservative. Find the amount of work done in moving an object in this field from $(1, -2, 1)$ to $(3, 1, 4)$. (14)
- (c) Show that $\nabla \times (\nabla \times \mathbf{A}) = -\nabla^2 \mathbf{A} + \nabla(\nabla \cdot \mathbf{A})$. (7)
4. (a) If $\mathbf{F} = y\mathbf{i} + (x - 2xz)\mathbf{j} - xy\mathbf{k}$, evaluate $\iint_S (\nabla \times \mathbf{F}) \cdot \mathbf{n} dS$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 1$ above the xy -plane. (17)
- (b) Evaluate $\iiint_V \mathbf{F} dV$ where $\mathbf{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ and V is the region bounded by the surfaces $x = 0, y = 0, y = 6, z = x^2$ and $z = 4$. (18)

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SECTION - B

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

5. (a) State Gauss's divergence theorem. Apply this theorem to evaluate $\iint_S (4xi - 2y^2j + z^2k) \cdot \bar{n} dS$, where S is the surface of the cylinder $x^2 + y^2 = 4$, $z = 0$, $z = 3$ and \bar{n} is the normal to S . (18)

- (b) Verify Stoke's theorem for $\bar{F} = (2y + z)i + (x - z)j + (y - z)k$ taken over the triangle ABC cut from the plane $x + y + z = 1$ by the co-ordinate planes. (17)

6. (a) Find $L\left\{\frac{1 - \cos t}{t^2}\right\}$. (15)

- (b) If $L\{F(t)\} = f(s)$, then show that $L\left\{\int_0^t F(u) du\right\} = \frac{f(s)}{s}$ and hence find $L\left\{\int_0^t \frac{\sin u}{u} du\right\}$ (10)

- (c) Find $L\{erf(\sqrt{t})\}$ (10)

7. Evaluate the following:

- (a) $L^{-1}\left\{\frac{S^2 + 2S + 3}{(S^2 + 2S + 2)(S^2 + 2S + 5)}\right\}$ (11)

- (b) $L^{-1}\{e^{-k\sqrt{s}}\}$ (12)

- (c) $L^{-1}\left\{\frac{1}{(S-1)\sqrt{S^3}}\right\}$ by using convolution theorem. (12)

8. (a) Solve $Y''(t) - tY'(t) + Y(t) = 1$, $Y(0) = 1$, $Y'(0) = 2$ by using Laplace transform. (15)

- (b) A body weighing 8 lb falls from rest towards the earth from a great height. As it falls, air resistance act upon it, and this resistance assumed to be numerically equal to $2v$ in (pounds), where v is the velocity (in feet per second). Find the velocity and distance fallen at time t seconds (Use Laplace transform). (8)

- (c) Evaluate: $\int_0^\infty \frac{\sin tx}{(x+1)\sqrt{x}} dx$ by using Laplace transform. (12)

EXTRA

L-2/T-1/CE

Date : 26/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2012-2013

Sub : **CE 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) Describe the composition and properties of Pyroxene group of minerals. With the help of a neat sketch, also explain the property of cleavage of this mineral. (20)
(b) Explain the term texture of rocks. What are the principal types of texture found in igneous rocks, what conditions of cooling are responsible for formation of these types of texture? (15)
2. (a) Using a neat sketch, illustrate the elastic rebound theory of earthquake. (20)
(b) Using neat sketch of a Seismograph recording, how would you determine the magnitude of an earthquake? Explain. (15)
3. (a) Define a pluton. With the help of neat sketches describe the following plutons; (20)
 - (i) Sills
 - (ii) Dikes
 - (iii) Laccolith and
 - (iv) Batholith.
(b) Write down the % composition of various minerals found in granite. What is its texture? Explain how this type of texture is formed. (15)
4. (a) What are the types of waves produced during an earthquake? Using neat sketch show the stages of deformation of a block of material during passage of the compressional type wave. (20)
(b) The zones of high seismic activity are perhaps the best single guide to plate boundaries. Briefly state the four main types of boundaries. (15)

Contd P/2

CE 203

SECTION – B

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

5. (a) Write short notes on (i) Rectangular, (ii) Trellis and (iii) Radial types of drainage patterns with diagrams. (15)
- (b) What is Rational Method? Why is it so prominent among all the methods? What are the limitations of this method? What are the assumptions of this method? Explain how we calculate the runoff coefficient of a real world area which has different land uses within the same basin? (20)
6. (a) Explain the following terms: (i) Drainage Density and (ii) Stream Frequency. With Bangladesh context, explain (with diagram) how these parameters can vary among the different regions. (15)
- (b) Discuss the variation of the various morphological parameters of a river basin as it flows in the downstream direction. Explain these variations in the context of Bangladesh. (20)
7. (a) Explain how size of the drainage basin, shape of the basin and soil moisture deficiency influence the runoff pattern. Explain with the impacts on hydrographs. (15)
- (b) What is river transportation? What are the factors affecting the transportation power of a 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) Using a neat sketch show the distribution of earthquakes at divergent plate boundaries. (15)
- (b) Draw a neat sketch of the crust of the earth showing epicenter, surface faulting, faulting at depth and focus or hypocenter of the earthquake. (20)
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CE 203

21+3=24

L-2/T-1/CE

Date : 02/06/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T- B. Sc. Engineering Examinations 2012-2013

Sub : **HUM 353** (Accounting)

Full Marks : 140

Time : 3 Hours

sThe figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION - A

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

1. (a) What is the matching principle of accounting? (2)
(b) What are the four basic financial statements of accounting? (3 1/3)
(c) Rashed Ahmed started his own consulting firm, Ahmed Consulting, on May 1, 2013.

The following transactions occurred during the month of May. (18)

- May 1: He invested Tk. 3000,000 cash in the business.
May 2: Purchased office equipment for Tk. 30,000, out of which Tk. 10,000 was paid in cash and remaining on account.
May 3: Purchased supplies of Tk. 15,000 on account.
May 5: Paid Tk. 1250 to advertise in the Daily News.
May 12: Withdrew Tk. 1000 cash for personal use.
May 15: Performed services costing Tk. 25,000, of which Tk. 20,000 was received in cash.
May 20: Paid for the supplies purchased on account on May 3.
May 26: Borrowed Tk. 50,000 from Pubali Bank on a note payable.
May 30: Paid Tk. 3000 for utilities and Tk. 10,000 as employee salaries.

Required : Show the effects of these transactions on the accounting equation.

2. (a) What are the steps in the accounting cycle? (3 1/3)

(b) Luma Naser started a food shop, Pizza Home, On June 1, 2013. The following transactions took place during the first month of operation: (20)

- June 1 : Investment of Tk. 40,000 in the business.
June 2: Hired two employees to work in the shop. They will be paid a monthly salary of Tk. 8000 each.
June 5: Purchased some furniture for Tk. 50,000. A cash payment of Tk. 40,000 was made immediately; the remainder will be paid in next month.
June 10: Paid Tk. 3600 for 1 year insurance policy.
June 15: Earned Tk. 35,000 from customers; Tk. 25,000 was received in cash and the balance is due.

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Contd P/2

HUM 353(CE)

Contd ... Q. No. 2(b)

June 20: Incurred Tk. 700 of advertising cost in the daily News.

June 25: Collected Tk. 4000 from the accounts receivable.

June 28: Paid Tk. 7000 due to the Daily News.

June 30: Paid salaries expenses Tk. 16,000.

Required :

(i) Journalise the above transactions for June.

(ii) Prepare Cash ledger and Accounts Receivable ledger.

3. The Mount View Motel opened for Business on March 01, 2014. Its trial balance before adjustment on March 31, 2014 is as follows:

(23 1/3)

Mount View Motel

Trial Balance

March 31, 2014

Accounts titles	Debits (Tk.)	Credit (Tk.)
Cash	3100	
Supplies	1400	
Prepaid insurance	1200	
Equipment	72000	
Accounts Receivable	13000	
Unearned rent revenue		6000
Accounts payable		8000
Capital		66,000
Rent revenue		20000
Advertising expenses	1400	
Salaries expenses	6200	
Utilities expenses	1700	
Total	100,000	100,000

Other data:

- Insurance expires at the rate of Tk. 200 per month.
- March 31 shows supplies of Tk. 800 on hand.
- Depreciation for equipment is Tk. 1000 per month
- One third of the unearned rent revenue was earned during the month.
- Accrued salary for March is Tk. 1800.

Required:

(a) Prepare adjusting entries on March 31, 2014.

(b) Enter the trial balance in a work sheet and complete up to adjusted trial balance columns.

Contd P/3

HUM 353(CE)

4. (a) The adjusted trial balance columns of the worksheet for Florin company are as follows:

(23 ⅓)

Florin Company		
Work Sheet		
For the year ended December 31, 2013		
Accounts Titles	Adjusted Trial Balance	
	Debit (Tk.)	Credit (Tk.)
Cash	8100	
Accounts Receivable	10800	
Supplies	1500	
Prepaid Insurance	2000	
Office Equipment	24000	
Accumulated Depreciation office equipment		5600
Notes payable		15000
Accounts payable		6100
Salaries payable		2400
Interest payable		600
Florin, Capital		15800
Florin, Drawing	7000	
Service Revenue		61000
Advertising expense	8400	
Supplies expense	4000	
Depreciation expenses	5600	
Insurance expense	3500	
Salaries expense	31000	
Interest expense	600	
Total	106500	106500

Required:

Prepare an income statement, owner's equity statement, and a classified balance sheet.
(Note that Tk. 9000 of the notes payable will be due in 2014).

SECTION – B

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

5. (a) Differentiate between cost accounting and financial accounting. (5)
- (b) Given below is the Cost Data of MM company for the year 2012. All the figures are in Taka. (18 ⅓)

Contd P/4

HUM 353(CE)

Contd ... Q. No. 5(b)

Material Purchase	3,80,000
Returns and Allowances of material	4,000
Direct Labor Cost	85,000
Factory machine insurance	20,000
Office design expense	50,000
Factory rent	25,000
Sales Revenue	13,00,000
Advertisement expense	40,000
Factory superintendent's salary	20,000
Office maintenance	13,000
Officer's salary	50,000

Inventory in units:	Beginning of the year	Ending of the year
Raw Materials	59,000	60,500
Work in process	34000	28000
Finished Goods	68000	55000

Requirement:

- (i) Prepare a Cost Statement for the year 2012.
- (ii) Calculate net income for the company.

6. (a) XYZ uses a job-costing system with two direct-cost categories (direct materials and direct labor) and one indirect-cost pool (machining support). Direct labor-hours is the allocation base for machining costs. In December 2008 machining cost budget is BDT 16,000,000 and 2008 direct labor-hour is 320,000.

At the end of 2008, XYZ has the following data:

	Model A	Model B
Direct Labor-hours	1800	2000

The 2008 actual machining costs were BDT 700,00,000 and the actual direct labor-hours were 884,000.

Required:

Compute the budgeted indirect-cost rate the indirect costs of two models.

(10)

- (b) IBM company has the two operating departments namely - Microchip department and Processor department, it has the following information-

(13 1/3)

Budgeted fixed cost	Tk. 4000,000
Practical capacity budgeted usages by:	20,000 machine hours
Microchip department	12,000 machine hours
Processor department	4,000 machine hours
Actual usages by:	
Microchip department	13,500 machine hours
Processor department	3,500 machine hours
Variable cost	Tk. 200 per hour

Contd P/5

HUM 353(CE)

Contd ... Q. No. 6(b)

Required:

Allocate the cost to the operating departments using

- (i) Single rate method
- (ii) Dual rate method and
- (iii) Practical capacity method
- (v) Which one is the best method? Explain.

7. (a) Define cost allocation and explain the purpose of cost allocation.

(3 1/3)

(b) Human Resources (H.R), Data Processing (D.P), and Risk Management (R.M) provide services to the Machining and Assembly production departments, and in some cases, the service departments also provide services to each other:

(20)

<u>Total Cost</u>	<u>Service Dept</u>	<u>Hours of services provided by the service department listed at left to:</u>				
		<u>H.R.</u>	<u>D.P.</u>	<u>R.M.</u>	<u>Machini ng</u>	<u>Assembl y</u>
tk90,000	H.R.	--	200	150	150	250
130,000	D.P.	100	--	50	150	200
80,000	R.M.	--	--	--	400	600
tk300,000						

	<u>H.R.</u>	<u>D.P.</u>	<u>R.M.</u>	<u>Machining</u>	<u>Assembly</u>
Costs prior to allocation	tk. 90,000	tk.130,000	tk.80,000	tk100,000	tk.60,000

Required

- (i) Allocate the service departments cost using

- 1. Direct method
- 2. Step down method
- 3. Linear Equation method

- (ii) Explain which method is the best.

8. (a) Explain the relationship among variable, fixed and mixed cost with graph.

(5 1/3)

- (b) Following data relates to a manufacturing company - TH Textile Limited:

(18)

Number of units produced and sold each year 70,000 and selling price per unit Tk. 200.

Variable cost per unit:

Direct materials	Tk. 20
Direct labor	Tk. 40
Variable Manufacturing Overhead	Tk. 10
Variable selling and Administrative expenses	Tk. 30

Fixed costs per year:

Fixed manufacturing overhead	Tk. 330,000
Fixed selling and administrative expenses	Tk. 150,000

Contd P/6

HUM 353(CE)

Contd ... Q. No. 8(b)

Requirement:

- (i) Compute BEP in units and in value. (BEP = Break - Even - Point).
- (ii) Compute Degree of Operating Leverage (DOL) and prove it by assuming 20% increase in sales.
- (iii) Prepare income statement if the selling price increases by 20.00 Tk. per units, fixed cost increases by Tk. 100,000 and the sales volume decreases by 10%.
- (iv) Compute the BEP in units if selling price increases by 10% and variable cost increases by 15%.
- (v) Calculate Margin of Safety in value and in units.
- (vi) What will be the amount of units to achieve the target profit after tax Tk. 500,000. Tax are is 30% on profit.

SECTION – A

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

Assume reasonable value for any missing data.

1. Compute the reactions and draw axial force, shear force and bending moment diagrams for the beam shown in Fig. 1. (26 ¼)
2. Using method of section, write equations for shear force and bending moments for the loaded beam of Fig. 2. Hence, draw shear force and bending moment diagrams. (26 ¼)
3. (a) A rectangular steel bar 15 mm wide by 30 mm deep and 6 metre long is simply supported at the ends. If the density of steel is 77 kN/m^3 , determine the maximum flexural stress caused by the weight of the bar. (16 ¼)
(b) What additional point load can be supported at the midspan if maximum flexural stress value is limited to 120 MPa for the steel bar of problem 3(a) above? (10)
4. The distributed load shown in Fig. 3 is supported by a wide flange section of given dimensions. Determine the maximum value of w_0 that will not exceed a flexural stress of 20 MPa and shearing stress of 0.8 MPa. (26 ¼)
5. (a) Show that the shearing stress varies parabolically over the depth of a rectangular beam cross-section with zero at the extreme fibres and maximum at the neutral axis. (13)
(b) Determine the maximum shearing stress expression for a thin tubular (circular) cross section. Show that this is equal to twice the average shear stress value for such a section. (13 ¼)

CE 211

SECTION – B

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

6. A horizontal rigid bar of negligible mass is hinged at A and supported by bronze and steel rods as shown in Fig. 4. Calculate the vertical displacement of point D due to the applied loading. Given that:

(26 ¼)

	<u>Steel</u>	<u>Bronze</u>
Area (mm ²)	500	400
E (GPa)	200	83
σ_{pl} (Mpa)	275	140

7. A beam is supported by a strutted cable as shown in Fig. 5. Find the horizontal and vertical components of reactions at A, B and D. If the allowable tensile stress is 140 MPa and the allowable compressive stress is 100 MPa, what is the required cross-sectional area of members AC, BC and CE?

(26 ¼)

8. (a) A 25" long aluminum rod is enclosed within a steel-alloy tube; see Fig. 6(a). The two materials are bonded together. If the stress strain diagrams are idealized for the two materials as shown in Fig. 6(b), what end deflection will occur for $P_1 = 98$ kips and for $P_2 = 165$ kips? Cross-sectional areas for steel and aluminum are 0.6 and 0.9 in² respectively.

(16 ¼)

(b) A 10-mm thick, low-alloy-steel plate 180 mm wide and 1500 mm long is subjected to a set of uniformly distributed frictional forces along its two edges, as shown in Fig. 7. If the total decrease in the transverse 180 mm dimension at section a-a due to the applied forces is 10×10^{-3} mm, what is the total elongation of the bar? Let $E = 200$ GPa and $\nu = 0.25$.

(10)

9. Draw the angle of twist diagram for the shaft subjected to torque shown in Fig. 8.

(26 ¼)

10. (a) What is the diameter of pin B for the bell crank mechanism shown in Fig. 9 if $P = 75$ kN? The allowable shear stress is 100 MPa.

(16 ¼)

(b) Show that for a thin walled pressure container, transverse stress is twice of longitudinal stress.

(10)

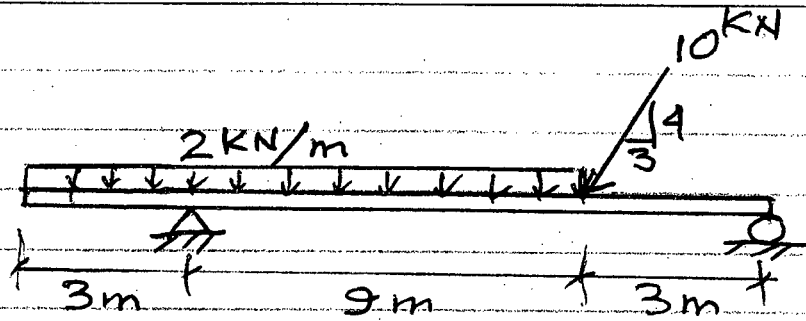


FIG. 1

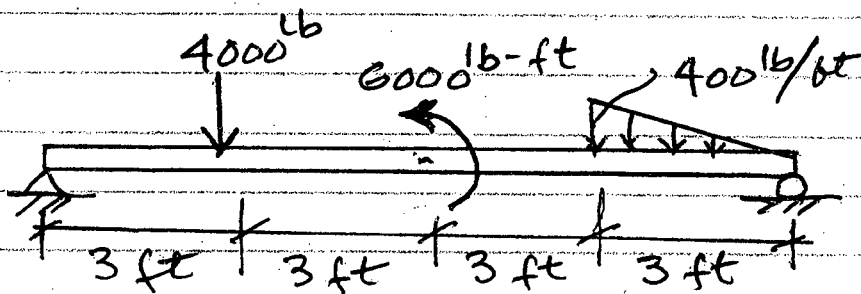


FIG. 2

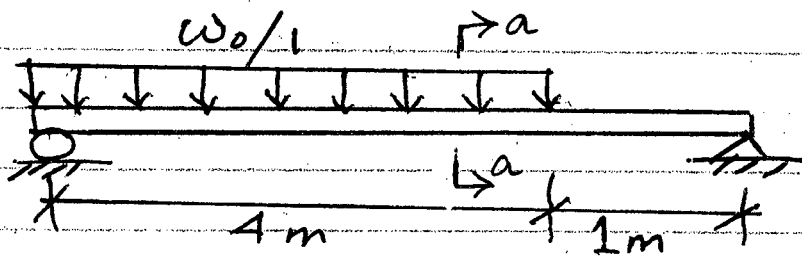
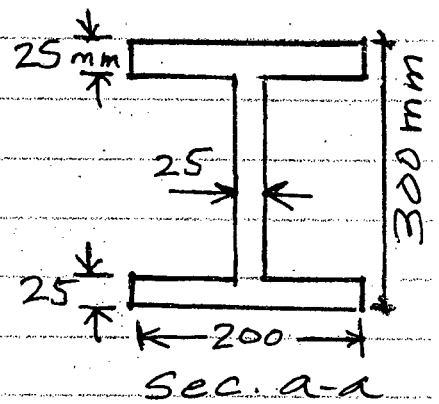


FIG. 3



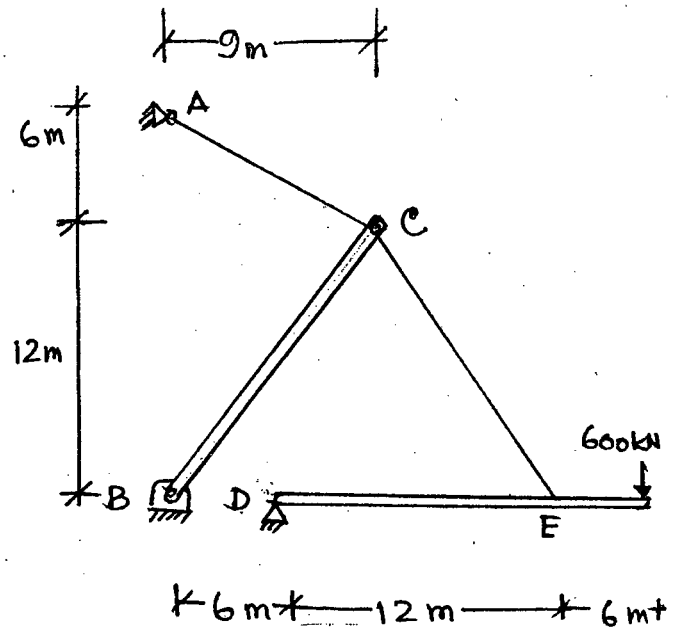
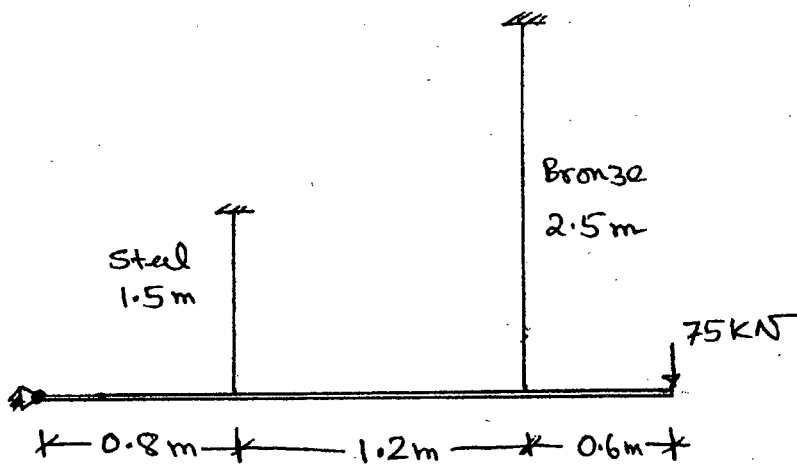


Fig 4

Fig 5

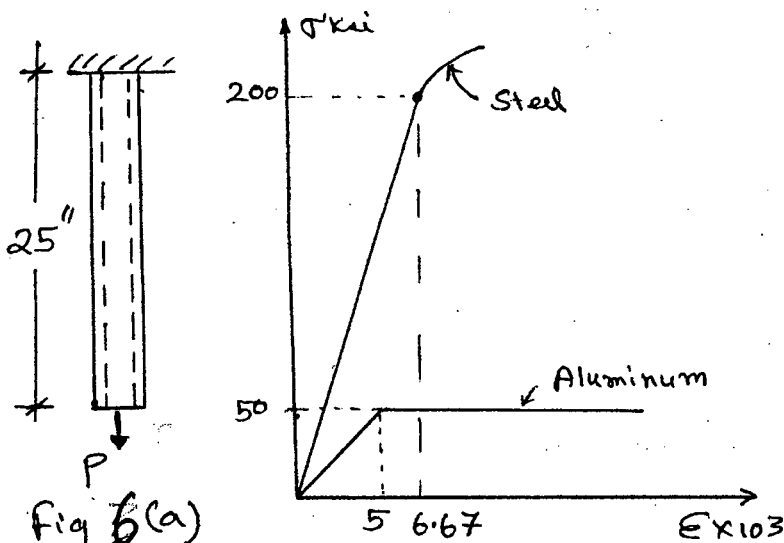


Fig 6(a)

Fig 6(b)

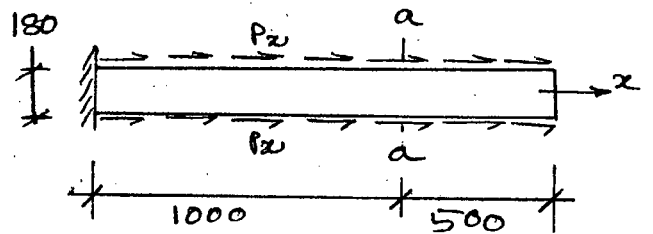


Fig 7

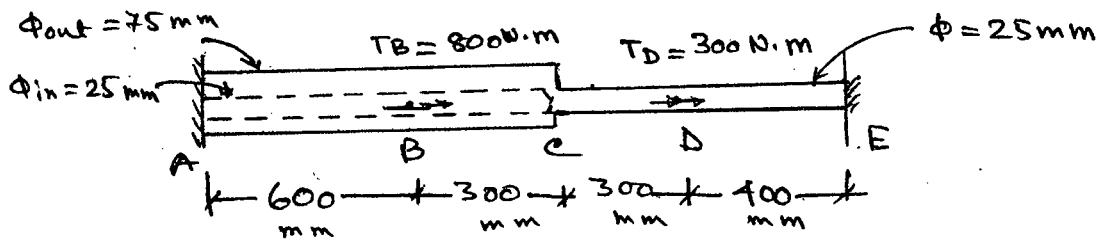


Fig 8

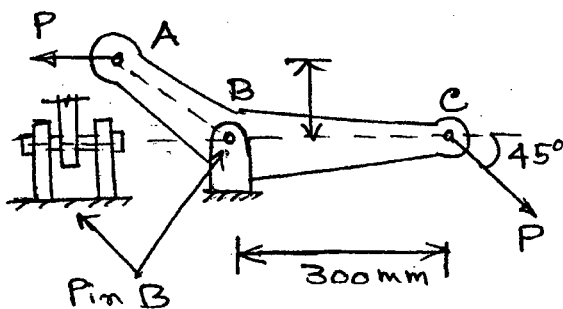


Fig 9